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CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Description of a Magnetic Apparatus for adding Adhesive Force to the Driving Wheels of Locomotives. By EDWARD W. SERRELL, Civil Engineer.

Almost all locomotives that have been built heretofore, have an excess of steam power over their adhesion, and where this is not the case, the great weight that necessarily ensues, in some cases amounting to several tons beyond what is required for the proper strength of the parts, is not only an unnecessary load to carry every mile that the engine travels, but is so much dead weight producing impact by which the track and bridges, and in fact the whole superstructure is sooner or later destroyed.

The difficulties railway companies experience are manifold from the use of heavy engines. Not only the track is destroyed, and the bridges impaired, but the machinery itself more readily wears out its own parts by their great weight, and much more lubricating material is required; but railway managers find themselves forced between the two horns of a dilemma; for if they use light engines, there is not adhesion sufficient to draw the heavy loads necessary to a profitable business; while if heavy machinery is employed, it works its own destruction and that of the track on which it moves.

The destruction of superstructure due to locomotives of great weights has been carefully computed by the learned commissioners appointed

by the States of New York and Massachusetts, and by several other eminent engineers, among whom may be mentioned my friend William Raymond Lee, who has accomplished much to put this important question in its true light, as has also Mr. McAlpine and Charles B. Stuart, and others, and it has been found that the depreciation from this cause amounts to upwards of $26,000,000 per annum in the United States alone.

Appreciating these difficulties, I went to work to see what could be done to remedy them, believing that science and experience combined could surely correct such grave errors, as there must be in a system that resulted so destructively to its own best interests, and to this end I drew upon the intelligence of all my good friends in this country, Canada, England, France, and Germany.

The replies, without exception, were, "You must increase the adhesion of the driving wheels without adding weight to the engine." This was known to be necessary; but how to do it was the difficulty; and although some encouraged the hope, and others suggested the belief that it could be accomplished by various mechanical contrivances; nothing was proposed, however, that had not before been tried, and I was about to give up the investigation of the matter, and consider the case as one of those inevitable troubles that surround every thing in some form, when reading the researches of my friend, the eminent philosopher, Dr. Henry, I was led to suppose that magnetism in some way might come to the rescue.

I was aware that attempts had been made in England to render the driving wheels permanently magnetic, and that the engineers of the *Chemins De Fer Du Nord*, in France, had tried various forms of electro-magnetic helices, but all these attempts had proved failures. I therefore set about making inquiries in this direction, from those best informed in that branch of physical science to which this subject belongs. I met, however, with little to hope from, perhaps, because of the preconceived idea, in one sense true, that a ring could not be magnetized; but struggling on, as one trying to find his way in an unknown place in the dark, and success has at last crowned the effort.

The apparatus consists of a helical coil of copper wire or some other proper electrode placed transversely to the wheel and around the lower segment, in such manner that the wheel may revolve freely within it without at any point coming in contact with it. The helix is sustained in any convenient way to the frame of the engine, and consists in the experiments tried of about 300 turns of No. 8 copper wire, insulated with cotton and marine glue.

One peculiar feature of the helix is, that it is a segment struck from a radius of the diameter of the wheel, which was found to be necessary in order that the greatest magnetic effect might coincide with the point of contact between the wheel and rail.

My first battery consisted of sixteen Groves cells, so modified that they would not stop by the motion of the engine; each cell had about 300 inches of zinc surface, and corresponding opposites of platinum and carbon, and the cells were connected in sets of eight for quantity

—zinc to zinc, &c. My present batteries are a modification of SMEES and CHESTER'S, which are found to be much more convenient.

By this arrangement, with the ordinary thickness of tire, the wheel is so magnetized as to enable the engine to exert its whole steam capacity. With two out of four drivers magnetized, of the engine "*Anthracite*," of the Fitchburg company, it was found that there was an increased adhesion of the wheels, and consequently of the traction of the engine, of over 75 per cent. The steam capacity of the engine being nearly double its adhesion without magnetism, enabled me to use the whole of the magnetic effect.

I am indebted to Mr. O. D. Vormus, of Boston, for very important aid in the experimentations, the troubles and difficulties attending which I shall not weary you with.

The engine "*Lebanon*" of the Central Railway of New Jersey, has two helices of 288 turns of No. 8 copper wire, on the front pair of the four driving wheels, which are four and a half feet in diameter, and the battery is made in four cells, each having twenty square feet of zinc surface, and eighteen feet of silvered lead coated with platinum, sulphuric acid, (HO. SO_3,) 1, water 12 is used to excite action, and the battery is connected for intensity. I am now preparing a magneto-electric machine to produce the electric current, hoping to dispense with the use of the battery altogether, and if successful, the entire arrangement will be mechanical and independent of chemical apparatus. Some of the engines of the Central Road of New Jersey, and the Erie Railroad of New York, have from three to five tons dead weight of cast iron, that can be taken off, and has been put on to give adhesion, and is otherwise useless.

This arrangement not only saves the great additional useless weight carried, and which is so detrimental to the superstructure, but enables the engine to ascend high grades. With a model, an ascent of a plane of 300 feet to the mile is readily made when the wheels are magnetized. The same model will not go up a grade of eighty feet to the mile without magnetism, because the wheels slip. The model is merely illustrative, and is capable of carrying about two hundred pounds.

The following is the test applied to the *Anthracite:*

Engine chained up.

Slipped wheels on clean track in good condition; circumstances every way favorable to traction, without magnetism, 50 lbs. steam to the inch.

All the conditions alike and two wheels magnetized, slipped with 88 lbs. of steam per square inch; slippery track, 19 lbs. less steam to the inch, without magnetism; same conditions, with magnetism, required 35 lbs. steam to the inch.

The engine weighed 22 tons net, and the additional traction produced by the magnetism was equal to 17 tons of dead weight, but did not weigh any thing.

The "*Lebanon*" drew a coal train on a slippery rail equal to that which was being moved by another engine that weighed about fifteen tons more, and both starting together, the *Lebanon* kept out of the

way of the other for some forty miles or more, when a leak occurring in the fire-box, sufficient steam could not be made to turn the wheels, and eight of the cars had to be taken off. The train had, however, previously passed the heaviest summits of the road.

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*Submarine Electro-telegraphic Experiments.**

We were invited last week to witness some interesting Experiments on the Patent Caoutchouc Telegraphic Insulator, at Messrs. Silver & Co.'s Establishment at North Woolwich. Mr. West, inventor of the India rubber covered wire, conducted the experiments, and gave an account of his researches in connexion with the process. As long ago as 1838 he commenced using india rubber for insulating wires. In 1845 he entered into an arrangement with Sir Joseph Paxton, Mr. Charles Dickens, and other gentlemen, to lay down a submarine cable between France and England, on the caoutchouc insulating principle; but, although the sanction of the English Government was obtained to the undertaking, that of the French Government was withheld for so long a period as to render it impossible to carry it out at that time. But in 1846 a portion of the cable which had been made by Mr. West to lay down across the Channel was, with the consent of the Lords of the Admiralty, submerged in Portsmouth harbor, and a letter was read from Mr. Hay, the chemical referee and lecturer attached to the dock-yard, dated May 25, 1859, in which Mr. Hay states that, notwithstanding that the cable in question has been in constant use, exposed in places to the sun, strained over rough stones, frequently coiled and uncoiled, and treated very roughly, the insulation is now quite perfect, although thirteen years have elapsed since it was laid down. A portion of this cable was exhibited. Mr. West's improvements, for which he has taken out a patent, consist in manipulating and applying the india rubber. In consequence of this substance not becoming plastic at a low temperature, it is impossible to draw it on the wire like maccaroni or gutta percha; it is, therefore, wound spirally round it; but as caoutchouc is not homogeneous, and the want of cohesion in the overlapping would render it liable to the permeation of water, Mr. West was under the necessity of inventing a method of overcoming this defect. The experiments testified that he has perfectly succeeded, and specimens of his cable, which were exhibited, showed that the india rubber is rendered perfectly solid and homogeneous. The quick and easy manner in which it can be repaired in case of abrasion or cutting is another great advantage of his process, while experiments showed that the electric fluid is transmitted without lateral loss, thereby rendering the use of batteries of great power unnecessary. It has been ascertained that india rubber insulates ten times better than caoutchouc, which is too porous to admit of perfect insulation. Care must be taken, however, to use the Para caoutchouc, as that derived from the East Indies is of an inferior quality and becomes "treacley,"

* From the Lond. Athenæum, June, 1859.

and consequently unfit to act as a good insulator. Careful experiments made to test the resistance of the india rubber covered wire to great atmospheric pressure, showed that with a pressure of 1300 atmospheres, equivalent to between two and three times that of the greatest depth of the Atlantic, insulation remained perfect. Mr. West stated that the object of the Messrs. Silver was to invite public attention to their production, with a view to having the most searching investigation into its merits,—not dogmatically putting it forth as a perfect invention, but seeking to elicit by the most open and unreserved exposition of its qualities, the truth with regard to its capabilities. The importance of the subject cannot, indeed, be overestimated —particularly at this period, when the convulsed state of the Continent has, within the last few days, led Government to decide on laying down a submarine telegraph between England and Gibraltar. Successes have been achieved by gutta percha, while on the other hand, great losses have occurred. The successes have only been on short lines, while the reverses have been on long lines, and experience seems to show that after a few years' use caoutchouc deteriorates so sensibly as to be no longer a perfect insulator.

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*A Coincident Period in American Statistics.**

By adding successively a cipher or ciphers, the figures "29,636" will express the present (1st July, 1859) sum of the railroads, post routes, territorial extent and population of the United States. Thus we have approximately:

Miles of railroad, . . .	29,636
Miles of post-route, . . .	296,360
Square miles of territory, . . .	2,963,600
Mouths in population, . . .	29,636,000

—facts exhibiting in their representative numbers a progression equivalent to our dollar, dime, cent and mill system of money; and eminently typical of American "go-aheadativeness," which abhors to do anything by *halves*. Such a concurrence of arithmetical idiosyncracies may never again occur, and never will unless our "fillibusters" succeed in enlarging "the area of freedom" in a ratio commensurate with the expansion of our population and the development of our means of internal communication.

*From the Jour. of the American Geographical and Statistical Society, July, 1859.

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*The Hydraulic Lift at the Victoria Docks.** Invented by Mr. Edwin Clark.

On Wednesday, the 27th of July, many who are interested in the progress of science had the pleasure of seeing in successful operation at the Victoria Docks Mr. Edwin Clark's method of ship-lifting, which appears likely to supersede the graving dock for many purposes. Mr. Clark's apparatus consists of a series of thirty-two upright hydraulic

*From the Lond. Mechanics' Magazine, August, 1859.

rams, of ten inches in diameter, placed in a water-way in two lines of sixteen each, far enough apart to admit of a ship of any burden passing between. Each ram is fitted with a cross-head of wrought iron, and the cross-heads are supplied with long straps, to the lower end of which are connected girders extending across from row to row. These girders, when the rams are down, are of course at the bottom of the water. The pontoon, on which the ship is raised, is formed of wrought iron plate, strongly ribbed, the length and depth of which varies according to the size of the ship it is intended to lift. This pontoon is open at the top, and is of sufficient buoyancy, when empty, to support a vessel of very large tonnage. It is fitted with screw valves for admitting the water, so that in a very short time, when placed in position, it can be lowered down upon the cross girders. The rams are fed by a 50 lb. engine, which is fitted with twelve hydraulic pumps, $1\frac{7}{8}$th in. diameter, and 2 ft. stroke, working at 18 strokes per minute, and the pipes from these pumps, before branching off to the rams, communicate with a series of valves arranged in a place built for that purpose close to the lift. By means of eccentrics, which close the valves, any one of the rams can be disconnected at will from the supply, so that should one of the pipes burst, no danger can accrue to the ship, and the lifting process can be completed without delay.

At half-past 1 o'clock on Wednesday, the 27th, the pontoon being placed in position upon the girders, it was first filled and then lowered to the bottom of the water. After this the Jason, a ship of about 1000 tons burden, was warped in, and having been fixed in position by means of ten sliding blocks, which were pulled into contact with the sides and bottom by means of chains brought above the water line, the engine was set to work, and the whole mass rose gradually out of the water at a speed of one foot in three minutes. As the pontoon came above the surface, it relieved itself of the water it contained, and the valves being then closed, the buoyancy of the saucer itself supported the ship in a perfectly steady and satisfactory manner. The whole operation, from the beginning to the end, extended over the space of $1\frac{1}{2}$ hours, and the dead weight lifted, including the pontoon, was altogether above 1600 tons. There are four pontoons constructed, and others in course of construction, which when raised in this manner, and floated, are to be towed with their burden into shallow bricked recesses provided for that purpose, so that the hydraulic power can be continuously applied for raising purposes. During an entertainment which followed the experiment, or rather the operation, Mr. Edwin Clark laid before his audience a clear and concise description of his invention, and the obstacles he had had to contend with in bringing it to its present state of perfection.

The engraving No. 1 shows a cross section of the lift, with a ship in the act of being raised. A A are two of the columns in which the rams are placed; B shows one of the cross girders; C, the end of the pontoon; D D, two of the sliding blocks for steadying the ship; and E E are two double purchase crabs for raising weights, and lifting the rams when required. These can be run about any where upon the top platforms, and are very useful adjuncts.

Engraving No. 2 is a section, in detail, of one of the columns, showing the ram, which is lettered A, the cross-head B, the side rods C C, and the cap-plate D. It will be noticed that the hydraulic cylinder

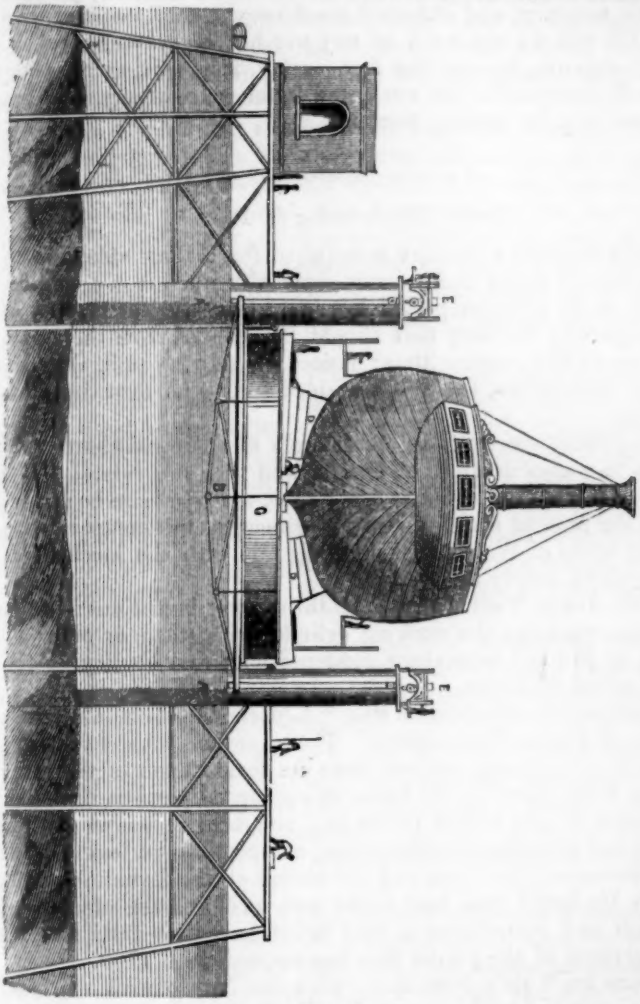
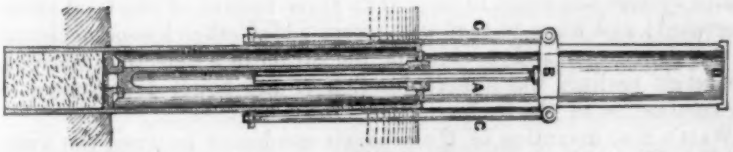


Fig. 1.

Fig. 2.



containing the ram rests upon a block of concrete, which fills up the inside of the column to the required height.

It will be needless for us to say much more upon the subject of Mr. Clark's invention. Its superiority over the old graving dock for many purposes is sufficiently manifest. Instead of a vast outlay upon excavations, masonry, and elaborate machinery in each instance, one hydraulic lift will do the work of any number of graving docks; and the only expense, beyond the first outlay, is providing an adequate number of pontoons for the work, and water space of any kind beyond three feet deep for floating them in.

Steam Engineering in 1859.*

Introductory.—No apology is required for calling attention to the present state of steam engineering, especially when it is a well-known fact that, at no previous period has there been a greater spirit of inquiry respecting the duty that should be realized from the steam engine than at the present time; indeed, it may be said, that among engineers themselves, there is a decided feeling of dissatisfaction on this point.

The following observations are entirely of a general character, preparatory to a consideration of details, and they are intended to refer to what *has been* done, what *is being* done, and what *can* be done; also how far the present state of steam engineering will compare with the days and deeds of Watt, after crediting him with the mechanical improvements of nearly a century.

In 1769, James Watt specified his three great inventions:—separate condenser; encasing the working cylinder with steam or other source of heat, to prevent premature condensation; and employing the expansive action of steam.

The title of this specification was, "A Method for Lessening the Consumption of Fuel in Fire-engines." The inventions were not merely mechanical improvements, but they were the development of the principle on which Watt based all his hopes of economy—namely, that HEAT IS THE SOURCE OF ALL POWER IN STEAM; and his aim was to prevent all needless and premature condensation, and consequent loss of power.

His correspondence also, and the nature of the inventions referred to, prove his belief that heat is the mainspring of the steam engine. The truth and correctness of that belief have been fully manifest in the experience of the period that has elapsed since 1769.

Previous to Watt's inventions, when, in Newcomen's engines, the condenser was the working cylinder itself, the waste heat in this defective system amounted to more than three-fourths of the total steam generated; and when to that waste were added other losses incidental to the generation and working of the steam in a defective machine, the result realized was a mere fraction of the power represented in the combustion of the fuel.

Watt's first invention of the separate condenser lessened the waste condensation to a great extent; his second invention of encasing the

*From the Lond. Artizan, May, 1859.

working cylinder with steam, &c., was only an extended application of the principle of the first; and his third invention of using the expansive action of steam, could only be applied with success in combination with the other two: indeed, they are such a united trio that, in condensing engines, neither can be dispensed with without involving a considerable loss of effect, even when working with steam of only atmospheric pressure.

It is not a doubtful but a well proved fact, that steam cannot be deprived of its temperature, without a proportionate loss of its pressure; it is also a well known fact, when steam of a certain temperature, say 250°, is brought into contact with iron, wood, or air, having a temperature of say 80° only, there is a constant action going on proportionate to the conducting powers of the low temperature material, by which the steam is deprived of a portion of its heat and pressure, and the loss thereby increases rapidly with the difference between the two temperatures.

As a homely illustration on this point, we may refer to the effect of different temperatures in the case of the human body and the atmosphere in which it may exist. In the human body, the average temperature is 90°, and we find that we cannot remain in a surrounding temperature of 32° without losing a considerable portion of our sensible heat.

The amount of the loss, by conduction and radiation, in the steam engine, is dependent on many circumstances. It is enough at present to draw attention to the fact that there is a loss, and that a considerable one.

To the appreciation of the importance of preserving the heat in steam intact, was due, to a great extent, Watt's success as an improver of the steam engine, and, whenever such preservation is neglected, loss and partial failure are inevitable.

It is not assumed that any new ideas or facts are developed in the preceding remarks; they are only intended to direct attention to those true principles of economy in the development of steam power, without which that economy is impossible, and one reason for referring to what may be termed first principles is, that we may have to trace present defects to their neglect.

There must, of necessity, be a difference between the results of theoretical calculation and those of practical experiment, but it is not a necessity that the amount of that difference should average more in 1859 than in the days of Watt, after crediting him with the advantages of mechanical construction we now possess.

It is to be feared that these mechanical advantages are more than counterbalanced by neglect of the true principles of economy in the use of steam, and that we are utilizing a smaller per centage of the total power of steam than Watt himself.

In these introductory remarks we shall not refer to certain sources of loss in the *generation* of steam, or to those arising from the difficulty of utilizing the heat in the condensed or exhausted steam; these will be referred to on a subsequent occasion.

We may fairly compare the duty of the steam engine, as improved by Watt in 1769, with the average duty realized by steam engines now in general use; and we will only notice *exceptive* cases when they prove that an increased duty is both possible and practicable.

There are three separate classes—the professional, manufacturing, and the purchasing—immediately interested in the construction of a steam engine, each of which has its own particular influence.

The professional engineer is comparatively of a late creation, and his influence is quite subservient to that of the manufacturer or the purchaser; his position and success in life are, to a great extent, dependent upon his opinions being somewhat in advance of the age, and if he unites a fair amount of scientific knowlege with sound practical experience, he will not encourage the perpetuation of unsound and defective engineering; his responsibility and power are at present very limited, and it would be unjust to blame him for departures from true principles, when such have been the result of circumstances over which he had no control.

The manufacturing engineer has to satisfy the claims of what are too often opposite and conflicting interests. On the one hand he is supposed to supply the market with the best description of steam engines, and on the other he has to make money, and avoid what may be called needless expenditure in producing his goods; he is also influenced by the opinions and requirements of his customers.

Now it does not follow that in manufacture the *cheapest* is the *best*; on the contrary, it is too often the other way, for it is well known, to produce an article at a cheap rate, and make the sale of it profitable, repetition must be encouraged, and alteration avoided.

To take an instance: in manufacturing a steam engine a certain outlay is required for patterns, and when it is purchased at the market price for engines of a certain class and size, in a general way, that price is not affected by the cost of the patterns; but it is of every consequence to the manufacturer, as a matter of profit or loss, whether that cost is debited to one engine or to twenty; it follows, therefore, that, in this instance, there is in the process of manufacturing steam engines a great inducement to repetition, in opposition to the more important demand for improvements tending to economy and general efficiency. And we may add, there is little hope of an immediate change in a system that, unfortunately, opposes such a strong barrier to real improvements, for the reason that a manufacturer will not ruin himself to benefit his customer.

We must look to the increasing intelligence among the purchasers and users of steam power for the change required, the influence exercised in the production and quality of steam power by the third or purchasing class being greater than is generally supposed. The man who holds the purse-strings is the man of influence, and the engineering character of the manufacturer has been, and always will be, greatly changed and modified by that of the purchaser.

Such a state of depressed improvement is not to be submitted to without a murmur, nor is it at all evident that great changes for the

better could not be made if the manufacturing engineer was more constantly and pointedly to enlighten the dark understanding of his customers.

The best interests of the employer of steam power are, in truth, identical with the purchase and use of the best and most economical machinery; and we believe the manufacturing engineer will ever prefer to lead the van in efficiency and economy, if he is allowed a fair profit on his manufactures.

And now, having stated *some* of the drawbacks to extensive improvements in the production and use of steam power, we wish to call attention to the actual efficiency of the steam engine of 1859.

We have previously referred to the three inventions specified by Watt in 1769, and we propose to inquire what actual duty *has been realized* in engines, constructed in accordance with the principles of that specification.

The first practical application of steam power was for the purpose of pumping, and in no class of engine have economical principles of construction received such attention as in that used for removing water from deep mines; and it may be observed incidentally, with reference to the expansive action of steam, it was peculiarly adapted to the conditions of pumping, where great variation of power was requisite.

In Cornwall the duty performed by pumping engines has been regularly tabulated for some years, and the amount of that duty has, in several instances, amounted to upwards of 90,000,000 lbs., raised 1 ft. high in an hour, with a consumption of a bushel of coals, or 94 lbs.; and if to the above duty is added the friction of the engine and pumps, an indicated or actual power has been, and can be, obtained by the consumption of *less* than 2 lbs. of Welsh coal per hour.

The average duty of a number of engines working at different rates of expansion in Cornwall may be much less than the above; but whenever due attention is paid to the maintenance of the heat of the steam in the cylinder, and full scope is allowed to expansive working, the above economy can always be realized.

In the case of condensing engines, for driving mills and manufactories, in which steam jackets and expansion have been combined, an indicated or actual horse power has been obtained, without difficulty, with a consumption *not exceeding* 2½ lbs. of coal per hour.

We therefore maintain that, by attending to the principles of Watt's specification, an indicated or actual horse power can always be obtained from a well made steam engine, on land or on sea, by a consumption of good steam coal *not exceeding* 2½ lbs. per hour; and we are aware that this statement is more moderate than well established facts require; indeed, there is every reason to believe we might fairly adopt a much higher standard of economy.

As a concluding remark on this part of the subject, in no instance on record has the best result or highest duty been realized without special arrangements for maintaining intact the temperature of the working steam and extensive expansive action.

Our next inquiry is:—What is the *average* duty realized at the pre-

sent time on land and on sea for the consumption of a given amount of coal? In reply to this, the following may be fairly assumed as undisputed facts:—

1. That, with land condensing engines, the average consumption of good steam coal per hour, to obtain an indicated or actual horse power, is *not less* than 4 lbs.

2. That, with marine engines of the best general construction, made by first class firms, the consumption of good steam coal per hour, necessary to obtain an indicated or actual horse power, is *not less* than 4½ lbs.

3. That, except in a few instances, no provision is made for *maintaining the temperature of steam* in the steam pipes and passages, and during its expansion in the cylinder, either in land or marine engines.

4. That the advantages derived from the expansive action of steam when the temperature of the steam is *not* preserved, are often so slight as to throw discredit on a principle which, when properly applied, is invaluable in economizing fuel.

The conclusions to be drawn from the above are far from satisfactory, and quite justify the tone of these introductory remarks.

The steam engineering of 1859 is in a most defective condition, and the results of such deficiency are incalculable.

In steamships alone we have at least one and a half millions of actual or indicated horse power; and if we only suppose this power to be exerted during one month out of the twelve, we are needlessly throwing away fuel to the amount of 100,000 tons per annum.

Figures and calculations must fail to convey a correct estimate of the loss incurred by defective steam engineering; and in the case of steam shipping, the actual amount of fuel saved is only a portion, and sometimes a small one, of the saving in freight, &c., resulting from coal space available for cargo.

The astonishment expressed at the economy resulting from the use of superheated steam indicates, only too truly, how far we have departed in practice from the first principles.

The facts, that the advantages to be derived from superheated steam can be obtained at a comparatively small outlay, and that its application is easy to existing machinery, will go far to bring it into favor; but it is matter of serious doubt if an improvement that is based on the existence of a previous defect is the *best of the kind.*

The economy resulting from superheating steam must convince the most sceptical that in all engines—where the cylinders are merely clothed to prevent radiation—at least from 20 to 30 per cent. of steam is needlessly condensed during its passage from the boiler to the condenser, and it is the surplus heat supplied from the superheated steam that prevents this waste, and saves the fuel.

We are but *entering* the field of improvement in steam engineering, and the amount of duty realized from the combustion of a pound of coal is at present but a small per centage of the total value of the heat given out by that coal.

Boilers, engines, condensers, must all be greatly improved; for each

has its peculiar source of waste, the sum total of which is well known to be considerable.

We have thus, as it were, just glanced at the state of steam engineering in 1859, being conscious of omitting mention of many incidental causes for present defects. When we proceed to refer in detail to steam engine construction, the opportunity will be afforded of embracing all points of interest.

(To be Continued.)

Formula and Table for Proportioning Arches of Wood or Cast Iron for Bridges. By JOHN C. TRAUTWINE, Civ. Eng., Philadelphia.

To the Editor of the Journal of the Franklin Institute.

The following formula, rules, and table, for deducing readily the dimensions of wooden or iron arches for bridges, were originated by myself for my private use; but supposing that they might occasionally prove serviceable to other members of the profession, I submit them for publication in your *Journal*, in case you entertain the same opinion.

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In wooden bridges in which the entire dependence for supporting the weight of both the structure and the load, is placed upon the curved ribs or arches; the rise of which neither exceeds one-fourth, nor falls below one-twentieth of their span; the formula

$$\left(\frac{\text{SPAN}}{4} \div \sqrt{14{\cdot}6\ \text{rise} - \frac{\text{SPAN}^2}{2125}}\right) + \left(\frac{\text{RISE}}{2000}\right)$$

Fig. 1.

will be found to give the side *a b* or *a c*, Fig. 1, of a single arch of any span whatever, which is square at its crown *a c;* and which, when completed by properly increasing its cross-sectional area from the crown towards the springs, or skewbacks *s s*, (by a simple process which will soon be described,) will sustain, *besides its own weight*, (estimated at 30 pounds to a cubic foot) a uniformly distributed load of $1\frac{3}{4}$ tons per foot lineal of span; and at the same time will not, in any part of its length, be subjected to a compressive strain exceeding about 800 lbs. per square inch; in no case varying more than 10 or 12 pounds from that limit.

With so trifling a deviation from exactness as 10 or 12 lbs. in 800, the formula may therefore, so far as regards its *practical* application to bridge arches, be considered as mathematically correct.

It will be observed that the single arch derived from this formula contains the *total area* of arch at crown required for the bridge. Of

course this arch will in practice be subdivided at least into two; each of which will present half the area of the calculated single one.

The formula is manifestly applicable also to those numerous plans of bridges in common use, which consist of trusses variously framed, but depend upon a straight upper chord for resisting compressive strains. It gives the *entire* area at centre of the upper chords, for a load of $1\frac{3}{4}$ tons per foot lineal, omitting the weight of the chords.

The arch is, of course, supposed to be so braced as to resist change of form from passing loads.

About 800 pounds per square inch is the limit assigned by our most eminent designers and constructors of bridges, as the perfectly safe compressive resistance of white and yellow pines and spruce,* which are the timbers almost exclusively employed for bridge arches; and the assumption has been very abundantly sustained by experience.

According to Hodgkinson, (the most reliable authority on the subject,) the ultimate resistance of white and yellow pines and spruce to crushing, is about from 5400 to 7000 pounds per square inch; consequently our limit is but from $\frac{1}{7}$ to $\frac{1}{8}$th part of the ultimate strength.

As to their weights, white pine is somewhat lighter than the others, but inasmuch as their averages when seasoned, generally range between 27 and 33 pounds per cubic foot, we shall not affect the truth of our results appreciably, if we assume each at 30 pounds, as I have done.

The formula reduced to words furnishes the following

RULE

For arches of any span whatever; with rises from $\frac{1}{20}$ to $\frac{1}{4}$th the span.

Square the span in feet. Divide this square by 2125. Subtract the quotient from 14·6 times the rise. Take the square root of the remainder. Divide $\frac{1}{4}$th of the span by this square root. To the quotient add the rise divided by 2000.

The sum will be *a b* or *a c*, Fig. 1, in feet, for an arch of spruce or white pine; and the area *a b c d*, as well as every other cross-sectional area of the arch, will be strained about 800 pounds per square inch by the weight of the arch itself, in addition to a uniformly distributed load of $1\frac{3}{4}$ tons per foot lineal of span, after the arch shall have been so enlarged from the crown towards the springs, *s s*, Fig. 1, as to equalize the pressure per square inch in all its parts.

When the rise exceeds one-fourth of the span, the strain per square inch of area as deduced from my formula becomes sensibly less than 800 pounds per square inch; and in a semi-circular arch is reduced to about 770 pounds.

Even this *extreme* want of coincidence is an approximation sufficiently close for all practical purposes; and proves that so far as *utility* is concerned, the formula will apply to rises from as low as $\frac{1}{20}$ to $\frac{1}{2}$ the span. Rises greater than $\frac{1}{4}$th the span have not been introduced into the table however. Not only because that rise is very rarely exceeded, but because I wished to maintain a practically perfect consistency throughout its extent. As it is, it far exceeds any limits that have yet been attempted.

*White pine is in England called Weymouth pine; and spruce, white fir or deal.

Now the strain at the centre of a bridge (whether the bridge consist essentially of an arch of wood, iron, or stone; or whether its dependence for resisting crushing strains is placed in straight upper horizontal chords;) is a purely *horizontal* one; and this *horizontal* strain is *uniform throughout the arch.*

In any of the foregoing cases this *horizontal* strain may be very readily computed.*

Fig. 2.

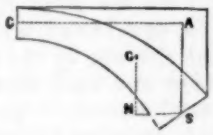
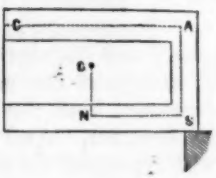


Fig. 3.



Each half of the span constitutes a lever, Figs. 2 and 3. It tends to fall by revolving on its fulcrum S, with a force represented by its weight multiplied by the *horizontal* distance *n s* of the centre of gravity G of that weight, from the fulcrum *s*, which distance is the leverage through which said weight acts. And it is prevented from falling by the counter-pressure of the other half, which acts horizontally against it at C, with a force represented by its weight multiplied by *n s*, and divided by the *vertical* distance *s a* from the fulcrum to C.

Hence the simple rule: Take one-half the sum of the entire weight of the bridge itself, and of its maximum distributed load, (making due addition for momentum.) Multiply this half sum by the *horizontal* distance *n s* of the centre of gravity G, of this half weight of bridge and load from the fulcrum or skewback *s*. Divide the product by the rise, or vertical distance *s a* from the centre of the fulcrum *s*, to the centre C of the depth of the arch or chord at the crown. The quotient will be the *horizontal* strain at C; and this horizontal strain in *the case of the arch* remains *uniform* throughout its whole extent. In the straight chord it does not; but we are not considering this subject.

In bridges of wood or iron, the distance of the centre of gravity of the half span and its load from the abutment at C, will usually be so nearly equal to $\frac{4}{9}$th of the clear span, that we shall not err materially in assuming it at that quantity, as I have done in my formula; but in stone bridges the position of the centre of gravity will be nearer the abutment, and must be ascertained previously to making the calculation. So much for the *horizontal* thrust, the only one sustained at C.

But at each skewback, or spring, *s*, the arch, sustains not only a horizontal force equal to that at the crown, but also a *vertical* one, arising from and equal to, the half weight of the bridge and its maximum distributed load, momentum, &c.

Consequently the cross-sectional area of the arch at the spring must be greater than that at the crown; and must bear to it the same ratio

* See Whipple on Bridge Building, Utica, New York, 1847; Haupt on Bridge Construction, and Bow on Bracing; both 1851; three of the best authorities on the subject.

that the resultant of the horizontal and vertical pressures at the spring bears to the horizontal pressure alone at the crown.

Fig. 4.

So long as the *thickness* of the arch remains uniform, if we take its *depth*, $a\,b$, Fig. 4, at the crown, to represent the amount of pressure at the crown, then will the depth $f\,h$ at the spring, of a properly proportioned arch, represent the pressure at the spring.

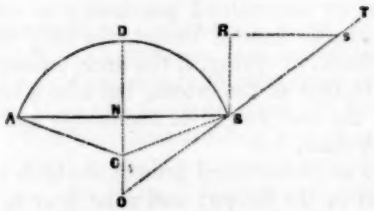
Therefore, if from the point f, we draw the horizontal line $f\,e$, equal to $a\,b$, and representing the horizontal thrust; and the vertical line $e\,g$, by the same scale, to represent the half weight of the bridge and load, then will the resultant line $g\,f$ represent both the total *amount* of pressure on the skewback, and its *direction*. And $f\,h$, drawn at right angles to $f\,g$, and equal to it, will represent the proper length and direction of the skewback joint.

The same result may be readily arrived at by calculation, thus: In any right angled triangle, as $e\,f\,g$, the hypothenuse $f\,g$, which represents the strain at the skewback, is equal to the square root of the sum of the squares of the two sides $e\,f$ and $e\,g$, which respectively represent the horizontal and vertical pressures at the skewback. In other words, if we add together the square of the horizontal pressure, and the square of the half weight of the bridge and its maximum load, and extract the square root of the sum, we obtain the entire strain at the skewback.

It is plain, that to ascertain the depth of an arch by this means, is a process of successive trials; because in order to know the strains produced in an arch, we must first know its dimensions and weight; but to obtain its dimensions and weight we must first know to what strains it is to be subjected. It is necessary, therefore, as a preliminary step, to assume certain dimensions, and from them to calculate the weight, and the strains resulting therefrom. If these calculated strains prove to be too large, or too small for the assumed arch, new dimensions must be fixed on, and a new trial made, until the required coincidence is secured.

The following very simple method of my own, possesses all the accuracy required in practice, and when used in connexion with my formula, gives the proper result at once.

Fig. 5.



Describe a small arc $a\,d\,b$; draw $a\,b$ and $n\,d$ proportioned to each other as the span and rise of the arch under consideration. In $d\,n$ continued

through the centre *c*, from which the arc was described, make *c o* equal to half of *n d*. From *o*, through *b* draw *o t*. Then is *b t* the *direction* of the skewback.

Next make the vertical line *b r* (by any convenient scale, without regard to the scale of the arc *a d b*) equal to the depth of the arch at the crown as deduced from my formula (as hereinafter explained).—Draw *r s* horizontally, intersecting *b t*. Then, *b s* measured by the same scale as *b r*, will give the length of the skewback, such that the pressure per square inch through the entire length of the arch will be the same. The *thickness* of the arch being supposed equal to the *depth* at the crown, and to be uniform throughout from crown to springs, it follows that the depth *b s* of the skewback multiplied by the thickness of the arch will give the cross-sectional area of the arch at the skewback.

It is only while thus obtaining the areas of cross-section of the arch, that it is necessary to suppose the arch to be of equal *thickness* throughout. Having once obtained the areas at crown and springs, the form into which these areas shall be thrown must depend on the judgment of the engineer, and will be affected by the nature of the material employed in the arch. If of wood, the cross-section will most probably be rectangular; but if of cast iron it will be made either **T**, **H**, or **O** shaped; or may receive whatever figure may be supposed best adapted to the peculiar case.

I repeat that the single arch found by the above process contains the *entire* area required for the bridge; and will be subdivided into two or more smaller ones, in each of which the areas at crown and springs must bear to each other the same proportions as in the large one.

The accompanying Table is intended to supersede to some extent the necessity for entering into a detailed calculation of the size of arch required in any particular case. It has been prepared from my formula. Therefore, when in any case it is found that the total weight to be supported by a wooden arch amounts to $1\frac{3}{4}$ tons per lineal foot of span equally distributed, (omitting the weight of the arch itself only,) the Table at once gives by inspection, the depth of arch at the crown; and since the thickness at that point is *supposed* to be equal to the depth, it follows that the square of the depth gives the *total* area of cross-section required at the crown. The depth at the crown being obtained, that at the skewback can be found in a few moments by employing the method illustrated by Fig. 5.

Thus, let us suppose that a single track railway bridge of 150 feet span, and with a rise of 15 feet, or $\frac{1}{10}$th of the span, has been designed, with the exception of determining upon the dimensions of arch required; and that the weight of the floor, bracing, and all other parts of the structure itself, *except the arches*, amounts to the quantity usual in such a bridge, of about ·45 tons per foot run of span; also, that the equally distributed weight of maximum extraneous load, including engine and train, snow, the effects of momentum, &c., be taken at 1·3 tons per foot run, (which I consider a fair allowance); making in all 1·75 tons per foot lineal to be supported by the arch. Now, what must be the dimensions at crown and skewback of one single wooden arch,

which by itself shall support this load safely, and not be strained in any part by a greater crushing pressure than about 800 lbs. per sq. inch?

We see at once by the Table, that the *entire arch area at* the crown must be $2{\cdot}607 \times 2{\cdot}607$ ft. $= 6{\cdot}80$ sq. ft., or $(6{\cdot}80 \times 144)$ 979 sq. ins.

Then to find the entire arch area at the skewback, describe [any small arc, (3 or 4 inches long will answer very well) as *a d b*, Fig. 5, of which the chord *a b* is equal to ten times the rise *n d;* that being the proportion in the present instance, of span to rise. Make $c\,o = \frac{1}{2}$ *n d;* through *o* and *b* draw *o t:* make *b r* vertically by any convenient scale, (without reference to the size of the arc,) to represent the centre depth, 2·607 feet. Make *r s* horizontal; then will *b s* be the *direction* of the skewback; and, measured by the same scale as *b r*, will be found to be 3·35 feet, the required *depth* of arch at the skewback.

Since the arch is *supposed* to be of equal *thickness* throughout, it follows that the *entire* cross-sectional area of arch required at the skewbacks is $2{\cdot}607$ ft. $\times\, 3{\cdot}35$ ft. $= 8{\cdot}733$ sq. ft., $= 8{\cdot}733 \times 144$, or 1257·6 sq. ins.

Consequently, the single track railway will, in this case, require two arches, each of which shall have a cross-sectional area at crown of $\frac{979}{2} = 489\frac{1}{2}$ square inches; and at skewback of $\frac{1257{\cdot}6}{2} = 628{\cdot}8$ sq. ins.

As before remarked, these *areas* may be disposed into such *forms* of cross-section as the judgment of the engineer may suggest.

At half way between the crown and skewback, measured along the chord or span of the arch, the area should be equal to half the sum of the areas at those two points; and so at any other intermediate point, a similar mode of proportioning should be observed.

Before closing this paper, I will work out in detail an example to show the correctness of the formula.

At present, I shall confine myself to explaining certain points necessary to be understood in order to render the table more generally useful in practice.

In the first place, as regards bridges whose combined weights (omitting in all cases the weight of the arches themselves,) and loads amount to more than $1\frac{3}{4}$ tons per foot lineal of span; as generally begins to be the case when the span much exceeds 150 feet.

The mode of proceeding in this case is very simple; and its principle self-evident. We have only to obtain the areas at crown and spring as if the load were but $1\frac{3}{4}$ tons per foot of span, as in the preceding example; and afterwards to increase them respectively in the same proportion as the increased total weight (omitting the arches,) per foot run exceeds $1\frac{3}{4}$ tons.

For instance, if in the preceding example, the arch had been required to sustain a weight of $2\frac{1}{4}$ tons per foot, instead of $1\frac{3}{4}$, we should have found the areas at crown and spring, precisely as was done; and afterwards have enlarged them for the $2\frac{1}{4}$ tons, thus:

Tons.		Tons.		Area at crown.		Area at crown.
1·75	:	2·25	: :	979	:	1258·6* sq. ins., for the new arch.

And,

Tons.		Tons.		Area at spring.		Area at spring.
1·75	:	2.25	: :	1257·6*	:	1616·9 sq. ins., for the new arch.

* This close coincidence was entirely accidental.

The engineer sometimes wishes to form at the moment an *approximate* idea of the size of arch required for a certain span, without the trouble of a previous calculation in detail of the dimensions and weights of the several parts of the structure; and I have endeavored to render my table subservient to this end, in the following manner.

I find by analyzing some of our best single track wooden bridges of about 150 feet span, that the weight of the structure itself (omitting the weight of the arches,) averages about ·45 ton per foot run of span; and that of this ·45 ton, about ·3 of a ton may be considered as invariable, without regard to span; while about ·15 ton increases, *per foot run* of span, nearly as the squares of the spans.

On this basis we have as the total weight per foot run of bridge and load, when the bridge is single track, and about 150 feet span, as follows (omitting the arches):—

·30 of a ton, invariable, or independent of span.
·15 of a ton, varying in other spans, nearly as the squares of those spans.
1·00 ton weight of train.
·30 of a ton allowance for momentum, snow, &c.

1·75 tons total weight per foot run of bridge (omitting the arches), and of maximum extraneous load.

Thus we see that of the 1·75 tons per foot run of a bridge of 150 feet span, only ·15 ton, or about $\frac{1}{12}$ part, must be considered as variable in calculating the weights corresponding to other spans. But inasmuch as this $\frac{1}{12}$th part increases as the *squares* of the other spans, it amounts to a serious item when the spans become very large.

In a span of 200 feet it will be thus:—

(Square of 150.) (Square of 200.)
22500 : 40000 : : ·15 ton : ·222 ton,

making the total *approximate* weight per foot run of span as follows:

·3 tons invariable weight.
·222 " variable nearly as squares of spans.
1·00 " weight of train.
·3 " momentum, snow, &c.

1·822 tons total per foot run in a span of 200 feet,

or $\frac{1}{24}$th part greater than in a span of 150 feet.

Therefore, when it is desired to ascertain *approximately*, by mere inspection of the table, the total cross section of arch at the centre of a span of 200 feet, so as not to be strained more than 800 lbs. per square inch, we must either add to the tabular *depth* its $\frac{1}{24}$th part, if we do not choose to subject the arch to a greater pressure than 800 lbs. per square inch; or we may employ the tabular depth itself in case a pressure per square inch of 800 lbs. $+ \frac{800}{24} = 833$ lbs. per sq. inch, is not considered too great. I say the *depth* only need be increased in making the calculation; because, as the *thickness* of the arch is *supposed* to remain uniform, the cross sectional area will increase in the same proportions as the depth.

By the same process, I find that for spans greater than 150 feet, we

must either increase the areas at crown, as deduced from the table in the following ratios, of column "depth"; or, by adopting the tabular results, subject the arch to the pressures per square inch given in column "pressure."

	Depth.	Pressure in lbs. per sq. in.
For 200 span, ...	1-24	833
" 250 "	1-7	915
" 300 "	¼	1000
" 350 "	·38	1104
" 400 "	·52	1216

Those, therefore, who do not consider 1000 lbs. per square inch as too great a strain, may use the tabular dimensions even for spans of 300 feet for railroad purposes. I, however, adopt Mr. Haupt's safe limit of 800 lbs.

These remarks are not intended to supersede calculation. The results to which they lead are necessarily, to some extent, incorrect; still they may be very useful when want of time prevents us from entering into a close computation, or where great accuracy is not required. We may, by this means, decide instantly upon the safety or otherwise of a bridge to which our attention may be directed; and where it is not essential to know the precise amount of strength. The ·15 of a ton per foot, which I have supposed to be *variable* in a span of 150 feet, must evidently depend in practice upon the design adopted for the bracing, &c.: —the height of the bridge—whether it is covered or not, &c.

For arches between about 100 and 150 feet span, the tabular values will be found to correspond very closely with the actual weights which occur in ordinary practice; and will need little or no modification in bridges of the usual forms of construction.

In the case of arches of *less* than 150 feet span, it would be natural to infer that inasmuch as the *variable weights* per foot run will *diminish* in such arches in the same proportion as the square of 150 bears to the square of the smaller span, therefore, the cross sectional *area* of the lesser arches themselves should diminish in the same proportions.

And if in small arches, as in moderately large ones, there were no other considerations to be attended to than their ability to resist with equal safety the simple horizontal and vertical strains hitherto referred to, such would be the case:

But in practice there are certain counteracting circumstances which render it expedient to increase rather than to diminish the proportional cross sections of arches, as their spans become shorter than about 100 ft.

It is easy to see that in the case of a 20 feet span, a very large and heavy locomotive, with the greater portion of its weight concentrated upon one or two pairs of driving wheels, and having these wheels near the centre of this short span, would be much more strained *per foot lineal of span*, than would a larger bridge having its floor covered from end to end with similar engines; and that it would consequently require a stronger arch than our assumed maximum load would assign to it.

Again, in small arches, the tabular dimensions become reduced to

such an extent, that, although they are unquestionably sufficient to sustain the deranging forces which have entered into our previous considerations; still it becomes very difficult so to arrange the shape of their cross sections as to secure the structure against the *lateral* forces to which it is exposed. And, moreover, the joints become so narrow that a very slight derangement of their parts will produce an inequality of bearing, and an undue excess of strain upon very small resisting areas, so as to endanger the splitting or splintering of the joints, and lead to the destruction of the work.

These remarks apply with peculiar force to small arches of cast iron. Suppose such an arch to have a thickness of bearing joints of but about $\frac{1}{2}$ an inch, or even less, as is very frequently the case. Here a displacement of but $\frac{1}{8}$th or $\frac{1}{4}$th of an inch, arising from any accidental occurrence, at once reduces the area of bearing surface to $\frac{3}{8}$ths or $\frac{1}{2}$ of that for which it was calculated, and renders the bridge unsafe. Moreover, when the parts become very reduced in thickness, they are too much exposed to injury from very slight blows inflicted either by evilly disposed persons or by accident.

These are not merely supposed cases;—I have witnessed them all in more than one instance; and although they are, to some extent, independent of the theoretical considerations which usually enter into the calculations for proportioning the parts of a bridge, still they are of sufficient importance to demand the attention of the practical bridge builder.

From the peculiar nature of the case, it is of course impossible to do more than assign certain arbitrary limits; leaving it to the judgment of the practitioner to vary them as he may see proper.

I can, however, confidently propose the following process, as giving, in my opinion, results which will be found satisfactory.

In arches under 100 feet span, let the cross sections, as deduced from my Rule and Table, be increased as follows:—

Divide the tabular depth by the quotient of the span divided by the rise. Multiply the quotient by 100. Divide the product by the span. Add the result to the tabular depth; letting the *thickness* remain as before.

This method gives for a span of 20 feet, with a rise of 5 feet, or $\frac{1}{4}$th of the span (and which has the smallest area comprised in the table), a depth of 1·325 feet, and a breadth of ·589 feet; or a total centre cross sectional area of arch of ·7804 sq. feet, or $·7804 \times 144 = 112·4$ sq. ins. This will be divided into two arches, each of 56·2 sq. ins. area.

On the application of my Rule and Table to cast iron, it must be borne in mind that white and yellow pine and spruce weigh about 30 lbs. to a cubic foot, while cast iron weighs about 450 lbs. to a cubic foot, or 15 times as much.

The safe compressive resistance of white and yellow pine and spruce, is about 800 lbs. to a sq. in., or $\frac{1}{8}$th of its ultimate resistance of 6400 lbs.

The safe compressive resistance of cast iron is about 12,000 lbs. to a sq. inch; or $\frac{1}{8}$th of its ultimate resistance of 96,000 lbs. per sq. inch.; or 15 times as great as that of pine or spruce.

Therefore, a cast iron arch of the same span and rise as a wooden one, but of only $\frac{1}{15}$th the area of cross section of the wooden one, will weigh the same and be as strong as the wooden one, so far as respects its resistance to the crushing forces which we have considered.

Hence, nothing more would be necessary in applying my formula to any cast iron arches, than simply to calculate it first as if a wooden arch were intended, and then to take $\frac{1}{15}$th *the* area of cross section; but that on account of the greater brittleness of cast iron, and its inability to compress as wood does, and make close joints with equal bearings throughout, together with the reasons before assigned in alluding to cast iron arches, some increase of area is required; and I propose to use but $\frac{1}{8}$th of the area of wooden arches for cast iron ones—thus exposing the metal to but $\frac{1}{16}$th part of its ultimate crushing resistance. And I do not consider this more safe for iron bridges, than wood at $\frac{1}{8}$th of its ultimate resistance; and am confident that small cast iron bridges, calculated on the exact basis of the resistance of that metal to crushing as compared with wood, would be positively dangerous.

My Rule accords very well with several cast iron bridges of spans of about 30 feet, erected in the vicinity of Philadelphia; and which have for years borne the incessant passage of heavy engines and trains without evincing the slightest distress.

The most venturesome iron bridge of small span that has come under my notice was a city street bridge, dependent entirely upon *wrought* iron arches, 32 feet span, 6 feet rise, and 15 feet apart. Each arch presented a cross section at the centre of but $5\frac{1}{4}$ sq. inches. Whereas, my Rule gives for cast iron (which has about $\frac{1}{2}$ more resisting power than wrought,) 10 sq. inches, together with an increase to 13 sq. ins. toward the spring, which the bridge in question had not. Assuming the safe resistance of cast iron at 12,000 lbs., and of wrought at 8000 lbs. per square inch, which is near the truth, my Rule gives 3·7 times the strength of the bridge in question.

I have referred to these bridges of small spans more fully than I should otherwise have done, from the fact that my Rule gives results so small in comparison to the usual practice of European engineers, that its sufficiency for practical purposes might be doubted by some.

Some bridges by eminent English engineers, contain 6 or 8 times the quantity of metal that is necessary for the utmost safety; and evince either an extravagance, or a want of attention to details, that would ruin any American engineer.

Notwithstanding this waste of material, the failure of cast iron bridges of quite moderate spans is by no means an unfrequent occurrence in that country; while in the United States, no single instance of failure has, I believe, ever yet occurred. All our cast iron bridges, from spans of about 200 feet down, perform fully the duty required of them; and prove that in the *science* of that department, our engineers are not behind those of any other country. So far as my professional reading enables me to form an opinion, the bridges of Bollman in Baltimore; Murphy in Philadelphia; Haupt, Whipple, and others, evince a far nicer combination of the requirements of theory, with those of practice, than any others that have fallen under my notice.

TABLE—Showing the breadth, or the depth in feet at the crown of a single arch of yellow, or white pine, or spruce, so proportioned that when properly enlarged from the crown to the springs, it will sustain, *in addition to its own weight*, an equally distributed load of 1¼ tons, (or 3920 pounds) per foot lineal of its span; and which load will produce throughout the entire extent of the arch, a uniform compressive strain of about 800 pounds per square inch of its cross-sectional area.

These breadths and depths at the crown are deduced from the formula

$$\left(\frac{\text{SPAN}}{4} \div \sqrt{14{\cdot}6 \text{ RISE} - \frac{\text{SPAN}^2}{2125}}\right) + \frac{\text{RISE}}{2000} = \text{either breadth, or depth at crown.}$$

SPAN IN FEET	RISE ¼ SPAN.	RISE ⅓ SPAN.	RISE ⅜ SPAN.	RISE ½ SPAN.	RISE ⅝ SPAN.	RISE ⅔ SPAN.	RISE 1/10 SPAN.	RISE 1/12 SPAN.	RISE 1/14 SPAN.	RISE 1/16 SPAN.	RISE 1/18 SPAN.	RISE 1/20 SPAN.
20	·589	·657	·720	·777	·831	·881	·929	1·019	1·101	1·178	1·250	1·318
30	·722	·807	·882	·950	1·019	1·081	1·141	1·251	1·342	1·446	1·520	1·620
40	·835	·932	1·021	1·102	1·179	1·252	1·320	1·447	1·564	1·674	1·778	1·875
50	·935	1·044	1·144	1·234	1·321	1·403	1·478	1·621	1·753	1·877	1·993	2·105
60	1·025	1·146	1·255	1·345	1·449	1·524	1·623	1·779	1·924	2·062	2·190	2·313
70	1·108	1·238	1·356	1·464	1·567	1·664	1·754	1·920	2·083	2·232	2·372	2·507
80	1·186	1·326	1·451	1·568	1·678	1·782	1·879	2·063	2·232	2·392	2·544	2·688
90	1·259	1·407	1·541	1·653	1·781	1·894	1·997	2·193	2·374	2·546	2·707	2·862
100	1·330	1·485	1·627	1·758	1·881	1·998	2·109	2·316	2·509	2·690	2·862	3·027
125	1·490	1·666	1·824	1·972	2·111	2·244	2·368	2·603	2·822	3·029	3·226	3·414
150	1·637	1·829	2·004	2·166	2·321	2·466	2·607	2·866	3·111	3·343	3·562	3·774
175	1·772	1·982	2·171	2·348	2·516	2·675	2·826	3·113	3·381	3·636	3·879	4·114
200	1·899	2·124	2·328	2·519	2·699	2·870	3·034	3·346	3·637	3·917	4·182	4·439
225	2·019	2·258	2·476	2·681	2·874	3·057	3·233	3·567	3·882	4·184	4·473	4·753
250	2·135	2·386	2·618	2·835	3·040	3·235	3·423	3·781	4·116	4·443	4·755	5·059
275	2·244	2·509	2·757	2·984	3·201	3·408	3·608	3·987	4·348	4·695	5·026	5·358
300	2·349	2·630	2·885	3·127	3·356	3·574	3·786	4·189	4·571	4·940	5·300	5·651
325	2·450	2·742	3·012	3·266	3·505	3·735	3·959	4·384	4·790	5·182	5·566	5·943
350	2·549	2·852	3·135	3·400	3·650	3·892	4·127	4·575	5·005	5·421	5·829	6·231
375	2·644	2·961	3·255	3·531	3·794	4·046	4·292	4·763	5·217	5·657	6·091	6·519
400	2·736	3·065	3·371	3·659	3·934	4·197	4·454	4·947	5·424	5·890	6·349	6·804
425	2·828	3·168	3·485	3·784	4·071	4·345	4·613	5·130	5·631	6·122	6·609	7·091
450	2·916	3·267	3·595	3·907	4·204	4·490	4·769	5·310	5·835	6·352	6·865	7·379
475	3·003	3·366	3·705	4·027	4·337	4·634	4·925	5·489	6·039	6·582	7·131	7·668
500	3·087	3·462	3·813	4·143	4·465	4·775	5·077	5·664	6·238	6·809	7·395	7·960
550	3·252	3·650	4·022	4·377	4·716	5·052	5·377	6·015	6·641	7·288	7·906	8·556
600	3·412	3·831	4·226	4·603	4·967	5·325	5·672	6·363	7·045	7·735	8·439	9·168
700	3·718	4·180	4·618	5·042	5·453	5·859	6·256	7·052	7·856	8·685	9·551	10·470
800	4·010	4·514	4·996	5·466	5·926	6·381	6·833	7·749	8 691	9·685	10·750	11·910
900	4·288	4·837	5·365	5·882	6·392	6·901	7·412	8·460	9·564	10·760	12·080	13·570
1000	4·559	5·152	5·726	6·291	6·855	7·437	7·998	9·196	10·491	11 930	13·580	15·550

I will now work out an example, to show the reliability of the formula,

$$\left(\frac{\text{SPAN}}{4} \div \sqrt{14{\cdot}6 \text{ rise} - \frac{\text{SPAN}^2}{2125}}\right) + \left(\frac{\text{RISE}}{2000}\right), = \text{depth or breadth at}$$

crown for a load of 1·75 tons per ft. lineal of span, (exclusive of weight of the arch itself.)

We will take a span of 300 feet, with a rise of 50 feet, or $\frac{1}{6}$th of the span.

First to get the depth at centre.

Here $\frac{1}{4}$ the span = 75 feet.

14·6 the rise = 730 feet.

$$\frac{\text{SPAN}^2}{2125} = \frac{90{,}000}{2125} = 42{\cdot}353.$$

$$\frac{\text{RISE}}{2000} = \frac{50}{2000} = {\cdot}025.$$

$$14{\cdot}6 \text{ rise} - \frac{\text{SPAN}^2}{2125} = 730 - 42{\cdot}353 = 687{\cdot}647.$$

$$\text{The square root of } 14{\cdot}6 \text{ rise} - \frac{\text{SPAN}^2}{2125} = \sqrt{687{\cdot}647} = 26{\cdot}2230.$$

And,

$$\frac{\frac{1}{4} \text{ span}}{26{\cdot}223} = \frac{75}{26{\cdot}223} = 2{\cdot}8601.$$

And $2{\cdot}8601 + \frac{\text{RISE}}{2000} = 2{\cdot}8601 + {\cdot}025 = 2{\cdot}8851$ feet, the *depth* as well as the thickness, at crown, as per table. Consequently, the area of the single arch at crown, is 2·8851 feet × 2·8851 feet = 8·3238 sq. feet, = 8·3238 × 144 = 1198·63 square inches; and the area at crown of each of the two small arches, into which it must be divided in practice, will be half as great, or 599·32 square inches.

My table was calculated by the foregoing process.

We must now proceed to find the weight of an arch 2·8851 feet square *throughout its length*, and the *horizontal* strain which that weight, in addition to the load of $1\frac{3}{4}$ tons per foot run of span, will produce at the centre, and throughout the entire arch.

Now, the length of an arch of 300 feet span and 50 feet rise, is 321·75 feet and its cross section *throughout* being temporarily assumed at 2·8851 × 2·8851 = 8·3238 square feet, it contains 321·75 × 8·3238 = 2678·183 cubic feet; and at 30 pounds per cubic foot, it weighs 2678·183 × 30 = 80345·49 lbs. = 35·8685 tons.

Now, the load of $1\frac{3}{4}$ tons on every running foot of 300 feet span, amounts to 525 tons; and this added to the temporarily assumed 35·8685 tons weight of the arch = 560·8685 tons, the entire assumed weight of the bridge and its maximum load, including the allowance for momentum, &c.

The *horizontal* strain produced by this entire weight is found by multiplying one-half of it by one-fourth of the span; and dividing the product by the rise. That is

$$\frac{280{\cdot}4342 \text{ tons} \times 75}{50} = 420{\cdot}6514 \text{ tons}$$

temporarily assumed horizontal strain.

Next we must find the strain on each skewback which would result from this assumed 420·6514 tons of horizontal strain, combined with the vertical pressure arising from the assumed half weight of bridge and load, or 280·4342 tons.

As before stated, this strain will amount to the square root of the sum of the squares of these two forces, that is to

$$\sqrt{420{\cdot}6514^2 + 280{\cdot}4342^2} = \sqrt{176947{\cdot}60 + 78643{\cdot}34} = \sqrt{255590{\cdot}94}$$

$= 505{\cdot}5600$ tons temporarily assumed strain on each skewback.

Now, to find the area of the skewback, the thickness of the arch being supposed uniform; it follows that as the pressure at the crown is to the depth at the crown, so is the pressure at the skewback to the depth at the skewback; that is, as

Tons pressure at crown.		Feet depth at crown.		Tons pressure at skewback.		Ft. depth at skewback.
420·6514	:	2·8851	: :	505·5600	:	3·4674

and its area of cross-section will be 3·4674 ft. × 2·8851 ft. = 10·0038 square feet = 1440·55 square inches.

And the area at the skewback of each of the two arches into which it must be divided in practice, will be 5·0019 square feet, or 720·275 square inches.

Having thus obtained the areas at crown, and spring respectively, we are enabled to calculate the *actual* weight of the arch, as well as the *actual* pressures at crown and spring. Let us see what they are; as also whether the actual pressure on the arch is *about* 800 lbs. per square inch; and whether it is uniform throughout the length of the arch.

First, as to the actual weight of the arch.

Its cross-section at the crown is	8·3238	square feet.
And at the skewback, .	10·0038	"
	2)18·3276	"
Making its mean area, .	= 9·1638	"

Its contents, therefore, will be 9·1638 square feet × 321·75 feet = 2948·453 cubic feet.

And its weight, 2948·453 cubic feet × 30 pounds = 88453·59 pounds = 39·4833 tons.

Which added to 300 times $1\frac{3}{4}$ tons of load (or 525 tons) = 564·4833 tons of entire weight of bridge and load.

The horizontal strain resulting from this load is

$$\frac{282{\cdot}2417 \text{ tons} \times 75 \text{ ft.} \times \frac{1}{4} \text{ span}}{50 \text{ or rise.}} = 423{\cdot}3625 \text{ tons.}$$

This is the only strain sustained at the crown, where it is divided among 8·3238 square feet = 1198·6272 square inches.

Consequently, the strain per square inch at the crown is $\frac{423{\cdot}3625}{1198{\cdot}6272}$ = ·35321 tons = 791·19 lbs.; or *about* 800 pounds per square inch.

Finally, the strain on each skewback is composed of the horizontal strain of 423·3625 tons; and the vertical strain of one-half the weight of the bridge and its load, which is 282·2417 tons.

And it is equal to $\surd 423{\cdot}3625^2 + 282{\cdot}2417^2 = \surd 179235{\cdot}8 + 79660{\cdot}4$

$= \surd 2588996{\cdot}2 = 508{\cdot}8184$ tons.

And this is divided among the 1440·55 square inches of area of the skewback; giving the strain per square inch on each skewback

$= \frac{508{\cdot}8184}{1440{\cdot}55} = {\cdot}35321$ tons = 791·19 lbs. per square inch, the same as at the crown.

Should the calculated weight of a bridge of the foregoing dimensions, including its load, (but omitting the weight of its arches,) be 2, 2¼, or any other number of tons per foot run, the dimensions of its arches would still be found by first employing the foregoing process as if the weight were 1¾ tons per foot; and the areas of cross-section at crown and spring afterwards increased by multiplying them by 2, 2¼, or other number of tons; and dividing by 1¾ tons.

The use of my Table is to obviate the necessity for the preceding long calculation. By means of it, for spans of 100 or more feet, the depth and area at the crown, for a load of 1¾ tons per foot lineal of span are known by inspection; and those at the spring may be deduced therefrom in a minute or two by the process illustrated at Fig. 5. It then only remains to increase them in the same proportion that 1¾ tons bear to the weight per foot run of the bridge and load that may be under consideration.

For spans less than 100 feet, the depths in the Table must be modified by the rule already given for that purpose, before they are employed in practice.

I will add, that if *double the depths given in the Table*, be taken as the *crown* depths of *stone* arches; and if then the depth at springs be found by means of Fig. 5, I believe that a much closer approximation to correct proportions will be secured than is usually done.

AMERICAN PATENTS.

List of American Patents which issued from August 16, to September 13, 1859, (inclusive,) with Exemplifications.

AUGUST 16.

170. Machines for Punching Holes in Leather; G. L. Bailey, Portland, Maine.

Claim—1st, The arrangement and combination of the bed-piece, lever, and hollow cutter, provided with a standard, connecting rod, and treadle. 2d, The arrangement of the circular adjustable cutter bed, in such a relative position to the cutter as to accomplish the object specified.

171. Sewing Machines; Wm. T. Barnes, Buffalo, New York.

Claim—1st, Working the needles vertically and alternately in the same hole in the bed-plate, in the manner set forth. 2d, The arrangement of springs, 5 and 7, wedges, finger, spring, 18, and stop, in the manner specified. 3d, The arrangement of lever, 13, slide, and lever, 12, when said lever, 12, is provided with points, is pivoted to slide, and made to operate in the manner described. 4th, The arrangement of the ratchet wheel, a, serrated bar, and ratchet, e, with the spool-rod and levers, c c', as set forth.

172. Steam Generators; Mellen Battel, Albany, New York.

Claim—The combination with the tubes extending downward through the tube sheet or crown of the fire-box, or downward into a flue, and upward through the water above the tube sheet of the inner tubes, in the manner described.

173. Clothes Rack; T. D. Berry, Lowell, Massachusetts.

Claim—The construction of my clothes rack with divided centre, or of two sections, each to consist of centre-piece, slats, braces, and circumferential pieces, united to each other as described, when these two sections are combined with each other by plates, so hinged as to allow the rack to be folded and opened, both vertically and circumferentially, to obtain by this divided centre a rack suitable for use, when folded closely and circumferentially.

174. Sewing Machines; E. Booth, Troy, New York.

Claim—1st, The combination of an eye-pointed vibrating lever, and a looper, operating together in the manner set forth. 2d, The vibrating of the eye-pointed lever by a positive motion given to it by the rollers entirely, and as contradistinguished from the use of a spring of any kind, by which means I insure its reliable action under its rapid motions.

175. Horse Rakes; Maro Bradley, Dundee, Illinois.

Claim—The use of the recessed metal bar, spurs, rods or shoes, elastic bar, lever, slide rod, and projection, constructed and employed together, in the manner described.

176. Cabinet Furniture; J. D. Brown, Cincinnati, Ohio.

Claim—The arrangement of the folding ends, and the flaps or leaves hinged on the inside, for the purpose described.

177. Door Fastener; Henry Burt, Newark, New Jersey.

Claim—A permanent door-bolt made with the fastening plates, bolt-case, and bolt, secured and operated as described.

178. Running Gear of Carriages; Joseph Calef, Buffalo, New York.

Claim—The journal box, constructed as described, and combined with the friction rollers or slides. Also, the combination of the axle, journal box, friction rollers, and equivalents, and hub. Also, the arrangement of the jointed braces, in combination with the running gear of carriages, for the purposes set forth.

179. Water-closet; William S. Cart, City of New York.

Claim—Regulating the action of the cock or valve in water-closets by the joint operation of the lever and weight of water in the pan, whereby the cock or valve is kept open until the weight of water in the pan regulates the closing thereof. Also, the construction of the valve, c, with the balancing diaphragm, valve, 10, and spring.

180. Machines for Dressing Stone; H. Chauncy, Perry, Georgia.

Claim—The arrangement of the pick or hammer shafts, adjustable shaft, and adjustable traverse bar, combined in connexion with the reciprocating carriage and laterally moving or adjustable bed, in the manner set forth.

181. Pipe Connexions for Steam Boilers; A. H. Clear, Providence, Rhode Island.

Claim—Making the connexions between the injection pipe, or other similarly submerged pipe of a steam vessel, or any other vessel, with the side or exterior of the vessel, by means of a valve box situated within or between the inside and outside planking of the vessel, fitted with a valve, capable of being operated by a screw, or its equivalent, by a person on or above the deck of the vessel.

182. Manufacture of Machine Belting; J. H. Clifton, New Castle, Pennsylvania.

Claim—The process of manufacturing belting for machinery from fibrous material, as described.

183. Belting for Machinery; J. H. Clifton, New Castle, Pennsylvania.

Claim—Belting made of fibrous material, by the process set forth.

184. Clover Bolts; E. K. Collins, Chili, New York.

Claim—The combination and arrangement of two bolts in clover machines, when said bolts have a counter and upward movement, produced in the manner specified.

185. Mole or Drain Ploughs; T. S. Cox, Lafayette, Indiana.

Claim—The peculiar shape of the mole, c; by the forward movement of the mole, c, the earth is carried from the bottom of the ditch by means of the terraducts, from the point of the mole, D, to the rear of the

shank, and pressed more densely by the increased earth coming in contact with the convex end of the mole, c, in rear of the shank, in such a manner as to make a better arch and more durable than any heretofore made, leaving the bottom of the ditch almost entirely uncompressed; hence, I do not claim anything except the invention of the terraducts, ending in the convex on the top of the mole, c.

186. CARPET-SWEEPER; John H. Crane, Charlestown, Massachusetts.

Claim—The arrangement of belt, rotating guides, and driver pulley, operating in combination with carpet-sweepers.

187. INDIA RUBBER SPRINGS FOR RAILROAD CARS, &c.; T. B. DeForest, City of New York.

Claim—Composing a spring of a series of blocks or segments of a circle of vulcanized india rubber, placed and held between two parallel plates, or equivalents; but this I only claim when the series of blocks are so arranged and held between the two parallel plates, that their contiguous faces shall not come in contact, under light loads, but shall come into contact and give mutual support as the load increases.

188. SWITCHES FOR RAILROADS; Thomas Dougherty, Macon, Georgia.

Claim—The combination and arrangement of the flat bars and the stationary end plates, provided with the guide rails in connexion with the rails, constructed as set forth.

189. SELF-RELEASING WHIFFLE-TREES; Eugene Duchamp, St. Martinsville, Louisiana.

Claim—Operating the two rods simultaneously by means of the slotted guards, in combination with boxes and lips, in the manner specified.

190. ATTACHING THILLS TO VEHICLES; Eugene Duchamp, St. Martinsville, Louisiana.

Claim—The combination of the swivel coupling boxes having an elliptical slot through their ends, thill irons having fluked portions and hinged gates, or their equivalents.

191. CARPET-SWEEPER; Jacob Edson, Boston, Massachusetts.

Claim—Producing the motive power of the machine by means of a belt of rubber or gutta percha, interposed and running between the pulley or roller, and the surface to be swept or passed over. Also, arranging the guiding wheel upon the stationary hollow shaft or bushing, through which the axle of the bush shaft passes.

192. MOLE PLOUGHS; Asahel Elmer, Assignor to Nathan Elmer and Reuben M. Richard, Shabbona Grove, Illinois.

Claim—1st, In combination with the adjustable block on the plough beam, the scoring or leveling plough in advance of it. 2d, In combination with the plough beam and coulter, the swinging-weighted crane or lever, for preventing the careening of the plough, or for recovering its proper position after it has careened. 3d, The combination of a forked coulter, for cutting a wedge-shaped or tapering slice over the coulter gash, with a pressing or driving device for forcing down said slice, and thus packing the coulter gash. 4th, A mole or former made of a series of conical shaped sections, which increase in size or they recede from the coulter, and which are so linked together as that they may move in a horizontal plane, but be comparatively rigid in a vertical plane. 5th, In combination with the mole, the scorer or shoe on its rear section or end, said scorer forming a groove or channel in the bottom of the finished drain, for admitting the water into it, the sides of the drain being so closely packed as to prevent the water from entering there.

193. WHITE LEAD APPARATUS; D. R. Erdmann, Philadelphia, Pennsylvania.

Claim—A rotary cylinder, arranged with double wire nettings, in combination with a vat, provided with a tube.

194. FABRICS; Alex. Forot, Paris, France.

Claim—The manufacture of a new kind of fabric without weaving, composed simply of threads glued upon a base of paper, or any suitable kind of material, such fabric being left plain or ornamental, by embossing, or any other process.

195. SAWING MACHINE; Benjamin Fulgham, Richmond, Indiana.

Claim—1st, The combination and arrangement of the two frames, placed one within the other, and arranged so as to admit of the saws being adjusted vertically, and also moved horizontally, forward and back. 2d, The arrangement of the shafts with their respective gearing and the pulley, in connexion with the two reciprocating frames, whereby the saws are rotated, and at the same time have a reciprocating motion communicated to them. 3d, In combination with two circular saws, the inclined ways of the log carriage, for the purpose set forth.

196. MANUFACTURE OF COAL OILS; H. P. Gengembre, Alleghany, Pennsylvania.

Claim—The continual progressive and gradual destructive distillation of coal, or other bituminferous substance, for the purpose of obtaining therefrom the different products of distillation, by means and with the use of the apparatus described, or other equivalent.

197. MANUFACTURE OF POROUS RUBBER CLOTH; Charles Goodyear, New Haven, Connecticut.

Claim—As a new porous manufacture, pervious to air and water repellant, composed of a woven or equivalent fabric, and a thin porous coating of india rubber or allied gum.

198. INDIA RUBBER FABRICS; Charles Goodyear, New Haven, Connecticut.

Claim—The porous and water repellant manufacture, composed of a bat or fleece of cotton or other fibre and india rubber or allied gum, united and rendered porous.

199. CLASPS FOR SKELETON SKIRTS; Joseph Grunwald, City of New York.

Claim—The combination of the hoops or springs with the tape, by means of clasps, constructed as described.

200. CROSS-CUT SAWING MACHINE; James Hamilton, City of New York.

Claim—The manner of arranging the shaft, d, and its gear wheel, f, and bevel gear, r, in connexion with the bevel gear, s', and gear, s, on the shaft, l, so that said shaft, d, can be changed to stand horizontally and give motion to the saw, whether the said saw and the gearing therof be in a horizontal or vertical position, thereby adapting one machine to be moved by hand, in felling trees or sawing-up logs. Also, in combination with the aforesaid machine for sawing logs, the detachable frame, buck, and variable lever, for holding smaller logs while being sawed for firewood.

201. MOLE PLOUGHS; A. Hammond, Jacksonville, Illinois.

Claim—The shoe, provided with a knife and projection, arranged in the manner set forth.

[This is an improvement on the shoe or tooth of the mole or drawing plough, and consists in extending

a portion of the tooth out behind the standard, and forming a furrow or groove in the upper surface of it diminishing, as it reaches the extreme end, for the purpose of closing up the opening left by the standard to prevent the ditch from filling up again. It also consists in forming or affixing, in any suitable way, a pin or angular-shaped knife to the sole of the shoe, to open a place along the bottom of the ditch for allowing the water to pass up into the same and be drained off from below the ditch.]

202. SELF-ACTING WAGON BRAKES; B. S Healy, Cohocton, New York.

Claim—The combination of a forked pole with the hounds, whereby the pole is free to slide in its forks and operate the brakes without moving the forks backward in the hounds. Also, in combination with brakes pivoted to a fixed bar, I claim the brake blocks, arranged and connected with the brakes, as set forth, whereby the friction of the wheels on the blocks draws the brakes toward, and causes them to press with greater force against, the wheels.

203. CAR SEATS; William M. Henderson, Baltimore, Maryland.

Claim—1st, The construction of a railway reclining chair or couch, securely attached to the floor of the car, with the whole chair reversible, so as to face either end of the car. 2d, The mode of varying the height of the back of the chair, by making it in two pieces and suspending the lower portion. 3d, In combination with a chair, reversible as aforesaid, the double-acting foot-board, single reversing leg-rest, and means for extending it by the action of the arms of the chair.

204. HOSE COUPLING; Robert Heneage, Buffalo, New York.

Claim—The arrangement of the screw sections and packing upon the cone extension, as set forth.

205. VISE; H. C. Hunt, Ottumwa, Iowa.

Claim—Constructing a vise in such a manner that it will self-retain itself upon a table or bench.

206. COTTON SEED PLANTERS; John W. Huntley, Lane's Creek, North Carolina.

Claim—The vertical rotating toothed shaft, in connexion with the follower or gatherer placed within the hopper, and arranged as set forth.

207. MILL-STONE BUSHES; Levi S. Ives, Brooklyn, New York.

Claim—1st, The placing of a cylinder, D, which contains the spindle collar, blocks, and the adjusting wedges, within a cylinder, M, secured within the centre of the bedstone, the cylinder, D, being allowed a vertical movement or play within the cylinder, M, to permit of the vertical adjustment of the spindle, and consequently the runner or upper millstone, with but little friction, and keeping all the parts in position so as to prevent their derangement. 2d, The arrangement of the plates, J K L, with the washer and ring, or their equivalent, in connexion with the projection on the inner side of the cylinder, D, to prevent the casual turning of the blocks with the spindle. 3d, The plate, N, provided with the flanch and the dome-shaped cap, P, provided with the flanch, in connexion with the cap, T, and plate, the above parts being attached respectively to the cylinder, D, spindle collar, and driver, to form an air and a dust chamber.

208. MOLE PLOUGHS; H. R. Jerome, Monroeville, Ohio.

Claim—1st, The arrangement of a beam, carrying a mole plough, with the front and rear standards of the front and rear propelling wheels, and with the adjusting device. 2d, Providing the coulter with a series of notches, and arranging the draft-chain in one or other of said notches, and thus having the draft applied directly to the coulter. 3d, The combination of a coulter which is elliptical in form in its transverse section, with a mould which is conical at its front and rear ends.

209. APPARATUS FOR LIGHTING GAS BURNERS; Wm. B. Johns, of the United States Army.

Claim—Giving the wrench staff the jointed sections, so that a match inserted in the extreme section may illuminate the burner key while the gas is being turned on, and also serve as a torch to ignite the gas.

210. WASHING MACHINE; Thomas J. Jolly, Olean, Indiana.

Claim—The arrangement and combination of the treadle, sliding table, and rotary rubber, constructed in the manner set forth.

211. MACHINERY FOR MANUFACTURING ARTIFICIAL FUEL; Morris L. Keen, Rogers' Ford, Pennsylvania.

Claim—1st, The combination and arrangement of the mills, conveyors, mixing and heating cylinders, moulding and conveying apparatus, in the manner described. 2d, The combined use of the moulding apparatus, and of the tank or reservoir of water, for the purpose of receiving and moulding the heated and plastic material in said tank of water, for cooling the machinery and fuel, and for preventing the material from adhering to the machine. 3d, The combination of the endless apron with the moulding apparatus, operating in a tank or reservoir of water, in the manner described.

212. CLASPS FOR FASTENING BANDS ON COTTON BALES, &c.; Hazard Knowles, City of New York.

Claim—The method of securing straps by means of a roller, in combination with the wedge-formed mortise of the sleeve, which receives the strap, as described.

213. CHURN; S. S. Langdon, Cleveland, Ohio.

Claim—The described construction and arrangement of rotary churns, when the same are provided with the dash frame and chambers, arranged as set forth.

214. MOLE PLOUGHS; Joel Lee, Galesburgh, Illinois.

Claim—The two swords fitting closely together, the front one attached to the mould near the forward point, the rear sword pivoted near the rear point of mould. Also, the lever, in combination with the swords for operating or adjusting the front sword and the mould.

215. STOVES; John Magee, Lawrence, Massachusetts.

Claim—The arrangement of the pot-grate, the hot air chamber, the ring grate, the register, and the ash chamber, together and with direct descending and base flues.

216. TUYERE; Joseph P. Markham, Pennfield, Michigan.

Claim—1st, The use of the indented valve, in combination with the outlet passages, arranged in such manner that, by moving said valve back and forth underneath the outlet, it will admit the wind to, or shut it off from, said outlet, equally and gradually, on each side of the central tube. 2d, The mode of making the loose nozzle independent of the masonry for support, by the use of the tube and its socket, in combination with the ribs and corresponding rebates.

217. TOWEL RACK; Rufus Maxwell, Tucker Co., Virginia.

Claim—The construction of racks for endless towels, with a slot and opening, as described.

218. Binding Apparatus for Harvesters; Charles H. McAleer, Chambersburgh, Pennsylvania.

Claim—The apparatus or elevator for raising and compressing the gavel, constructed in the manner described.

219. Rotary Movement; W. Howard Mitchell, San Francisco, California.

Claim—Two or more reversed self-detaching pawls or catches, working on opposite sides of the periphery of the ratchet wheel, by being attached to arms working in parallel lines and in the same direction, constructed as specified. Also, the combination of the ratchet wheel with the pawls or catches, and flanches, and the cross-beam, with parallel arms. Also, the combination of the ratchet wheel with the flanched casing or flanches.

220. Rotary Steam Engine; George J. Montjoy and Joel B. Sawyer, Houston, Texas.

Claim—The arrangement of the passages in the double elbow piece and the reversing cock or valve, in combination with the passages in the stationary hollow shaft and its abutment, the whole applied in connexion with the cylinder and its sliding pistons.

221. Seed Planters; Willis G. Murphy, Seguin, Texas.

Claim—The arrangement of the beam, hopper, wheels, seeding wheel, helve, plough, covers, and conductor, as described.

222. Safety-rein for Bridles; Rudolph A. Nathurst and John L. Stewart, Nashville, Tennessee.

Claim—The connexion of the choke-strap with the common or ordinary driving reins, so as to act and serve for both purposes of driving and safety-rein, and this we claim whether it be temporarily or permanently affixed to the bridle or halter, whether a bit is used or not.

223. Skeleton Skirt; Cæsar Newman, City of New York.

Claim—The combination of the jointed or hinged hoop supporters, and a series of horizontal hoops, arranged in the manner described.

224. Steam Slide Valve; J. J. Parker, Marietta, Ohio.

Claim—Placing the valves loosely on the hollow arms of the side pipe, and contracting the supply openings from the valves, for the purpose of employing the pressure of the steam to keep the valves in contact with their seats.

225. Ball Furniture Casters; John C. Pedrick, Washington City, D. C.

Claim—Inserting into a metal cup containing the ball of a caster, a separate anti-friction bearing, against which the ball revolves, thereby lessening the friction of the ball in the metal cup or socket.

226. Trucks for Railroad Cars, &c.; Thomas E. Roberts, Allamance, North Carolina.

Claim—The construction and arrangement of the concave chilled plate and convex chilled plate with each other, in the manner described, and their combination with the self-oiling friction rollers.

227. Shears; James H. Roome, City of New York.

Claim—Combining one limb of a pair of shears, or other similarly operating hand-cutting instrument, with its handle forming part of a separate lever, and combining the said limb and handle with the other limb of the shears by means of an arm attached to the said lever, and operating on the rear portion of the first mentioned limb, a link, connecting the said limb with the said lever, and a movable fulcrum connexion between the said lever and the other limb, to cause the power of the said lever to increase as the shears close.

228. Carriage and Wagon Jacks; William N. Rowe, Sharpsburgh, Maryland.

Claim—The adjustable sliding catch plate, operating in combination with the grease box and jack, as described.

229. Percussion Pellet for Fire Arms; Jacob Rupertus, Philadelphia, Pennsylvania.

Claim—The employment for enclosing the detonating compound of a metal capsule of spherical form.

230. Stoves; John Schceper, City of New York.

Claim—The arrangement and combination of the fire chamber, ovens, and flues, as described.

231. Portable Iron Husk Grist Mills; Henry W. Shipley and Zobar Blair, Mount Vernon, Ohio.

Claim—The husk and cup, A′, composed of lower and upper sections, the same being turned and fitted together, and supported upon a frame, for the purpose of making the whole portable and complete in itself. Also, cementing the stone to the interior of the cup, A, which also forms the upper husk. Also, the cup, M, constructed as described, and cementing the stone thereto, so that both will revolve together. Also, the bridge trees, in combination with the husk, cup, A′, and frame, arranged as set forth.

232. Butter Worker; Henry Soggs, Columbus, Pennsylvania.

Claim—The tray, with convex bottom and ends set on an inclined plane of rollers, working in combination with the cylinder and ribs, for the purpose of working the milk and superfluous matter from the butter, at the same time leaving channels in said butter through which the milk, &c., may escape.

233. Slide Valves of Steam Engines; David Stoddard, San Francisco, California.

Claim—1st, The employment of the elastic plate, in combination with a cavity and a balance frame, as described. 2d, The combination of an adjusting spring and screw, with the elastic plate, as described.

[A flexible metallic plate is applied, in combination with a balance frame, between the back of a slide valve and the back of the steam chest, whereby the valve is relieved of unnecessary pressure, and caused to work with very little friction. This is the invention. The valve and the balance frame are constructed of a certain form, and a spring and set-screw are so applied, in combination with the flexible plate and balance frame, as to compensate for the wear of the frame, the valve, and seat.]

234. Steam Generator; William Mount Storm, City of New York.

Claim—1st, The plan or method of conveying water from a closed tank or reservoir to the heating surfaces of a steam generator by capillary attraction. 2d, So constructing and locating the said supply tank that the influence of the heat upon the water contained therein for feed, while elevating its temperature, shall in no case bring it up to the steam generating or boiling point under the given pressure.

235. Weighing Scales; Francis M. Strong and Thomas Ross, Brandon, Vermont.

Claim—The arrangement of the bars of the larger platform, to wit: one lever crossing the other at about right angles, so that the knife-edged bearings of the foot-pieces of one lever will be at right angles to those of

the other, and the lateral movement of the foot-pieces on the bearings prevented. Further, attaching the arms of the levers either separately or when connected direct to the beam, and having the bar of the scoop or smaller platform rest on knife-edged bearings on the beam.

236. BLANK FOR SHOE-PEGGING MACHINES; B. F. Sturtevant, Boston, Massachusetts.

Claim—A blank or strip of shoe pegs cut around the log, as described.

237. MACHINE FOR NICKING AND TRIMMING HEADS OF SCREWS; N. G. Thom, Cincinnati, Ohio.

Claim—1st, A revolving or rotating head, which revolves around a series of spindles or blank holders with an intermittent or interrupted motion, carrying upon it the necessary apparatus and tools for shaving, nicking, and trimming, or otherwise finishing the heads of screw blanks. 2d, In combination with the spindles or blank holders, the annular cam, having internal and external inclined surfaces, for the purpose of raising the spindle in the nicking process, and operating the grippers by acting upon the one rod. 3d, In combination with the spindles or blank holders, the rod, d, and spring, or its equivalent, when such a spring, or equivalent, is made to act upon the rod at required intervals, to discharge the blank, by being attached to some rotating or reciprocating portion of the machine. 4th, The lever, the spring, and catch, or other mechanical equivalent, which acts upon the machine, for the purpose of arresting one part while it releases another. 5th, The arrangement of the spindles and driving shaft in such a manner that, while the spindles containing the blanks to be shaved and trimmed are acted upon by the driving belt, the spindle containing the blank to be nicked is not acted upon, and the necessary tension is given the belt at all times in the revolution of the head without the use of a binder. 6th, In combination with the worm wheel, or its equivalent, for giving motion to the cams, I claim the cam, Y, and tool cam, X, when acted upon in such manner that the said cams remain stationary while the head revolves, or nearly so, and the cams revolve while the head is stationary. 7th, Finishing the heads of screw blanks by an apparatus, by which the necessary tools for finishing the head are revolved round the spindles or blank holders, whether such blank holders are stationary or otherwise.

238. LAYING SUBMARINE TELEGRAPH CABLES; Andrew Turney, Jr., Fairfield, Connecticut.

Claim—The construction and use of an apparatus consisting of two hollow cylinders with longitudinal joints or hinges, and two discs or flanches, set obliquely to the cylinders, and a guide or regulating disc, to be attached to a telegraph cable, while the cable is being submerged, to check the rapidity of the sinking, and to afford a constant strain on it in the direction of the vessel which is paying out the cable, to avoid kinks or festoons.

239. WASHING MACHINES; John Wagoner and Abram Severson, Guilderland Centre, New York.

Claim—Mounting the revolving platform, K, and the pulley and gearing, or their equivalents, on the hinged platform, M, and so arranging the whole that, when M is turned up, the driving belt, o', is slackened, and the whole lies within or by the side of the main frame—and when M is turned down, the gravity of the tub, or equivalent vessel, tightens o, and causes the several parts to operate without any labor in adjusting.

240. CARDING ENGINES; Samuel Wethered, Baltimore, Maryland.

Claim—1st, A card-clothed main cylinder for carding engines, which performs a lateral vibrating movement simultaneously with its revolution. 2d, A card-clothed "fancy" or upper cylinder, which is capable of performing a lateral vibration as it revolves, in combination with a laterally vibrating card-clothed main cylinder.

241. HAT MEASURES; Julius Wehle, City of New York.

Claim—1st, The divided handle, in combination with the elastic oval strip, for the purpose of contracting the said oval strip. 2d, The scale, secured to one of the handles, and passing through an incision of the other handle, in combination with the screw.

242. HORSE POWER MACHINE; Y. B. Williams, Freeport, Illinois.

Claim—The arrangement and combination of the circular standard, toothed rim, ring, C, pinions, D, wheels, E, pinion, e, toothed ring, G, and pinion, H.

243. MACHINE FOR BUNDLING KINDLING WOOD; Wm. S. Williams, City of New York.

Claim—1st, The feeding clamps and slides, arranged and actuated in the manner set forth. 2d, The combination of the separating and dividing knife, with the concave wood carrier to convey the wood to the bundling apparatus. 3d, The sliding support, arranged to sustain the kindling wood as fed into the machine, and keep it in place. 4th, The curved gatherers, fitted and acting to deliver the bundle of wood and gather the next loose wood into a bundle. 5th, The conical gatherers, to concentrate and compress the bundle of wood. 6th, The stationary plate and segments, in combination with the conical gatherer to sustain the wood while acted upon. 7th, The plunger or press-block, acting to bring the ends of the bundle of wood level. 8th, The vertical moving frame forming the reception for the wire, and the guide for the apparatus that wraps said wire around the bundle of wood. 9th, In combination with the frame, I claim the chain to wrap the wire around the bundle of wood, and the clamp to hold the wire near the middle part thereof. 10th, The circular twisting jaws moving in dovetails, and acting, when revolved by competent means, to twist the ends of the wires together. 11th, The arrangement of the sliding and revolving shaft, in combination with the twisting jaws. 12th, The spring guides, to keep the wire straight while passed into the machine, in combination with the traveling jaw or clamp and with the shear.

244. PATTERNS FOR MOULDING; John Alexander, Assignor to self and James Ritchie, Brooklyn, New York.

Claim—The employment or use of a "former," with a pattern constructed of a plastic substance, and formed on or over the "former," to produce moulds in sand for the casting of hollow ware and other castings of the exact thickness required.

245. HANGING THE BODIES OF WHEEL VEHICLES; Charles Bradfield, Assignor to C. Stewart Bradfield, Philadelphia, Pennsylvania.

Claim—1st, Attaching the wheels to the body, by means of the arms secured to the traverse bars of the shafts or arbors, which are fitted on the flanches and bearings of the plates of the body, and having springs placed between their flanches and traverse bars. 2d, Attaching the thills to the body by means of the bars, fitted in the eyes, and secured thereon at the desired height by set-screws.

246. APPARATUS FOR SUPPLYING FURNACES WITH HOT AIR; Calvin Fletcher, Assignor to Addison C. Fletcher, Cincinnati, Ohio.

Claim—The arrangement of the fan and the steam chambers, A, communicating with the chambers, B C, together with the inlet steam pipes, E, the cold air passages, hot air pipes, G I I, and the pipes, F, for the discharge of the water of condensation.

247. Restoring Waste Vulcanized Rubber; Hiram L. Hall, Assignor to the Beverly Rubber Company, Beverly, Massachusetts.

Claim—The restoring of waste vulcanized rubber or gutta percha by the use of superheated steam, in the manner described.

248. Cotton Presses; Miles B. Hand, Assignor to self and Sheldon B. Hand, Handsboro', Massachusetts.

Claim—The combination of the toggles and screws, when the latter are connected to the driving or power shaft, or to a shaft connected therewith, by means of universal joints.

249. Churn; John J. Lehaye, Reading, Assignor to self and John Tucker, Philadelphia, Pennsylvania.

Claim—The vessel, cylinder, and reciprocating plunger, adapted to and arranged in respect to each other, as set forth, in combination with the devices described, or their equivalents, for enlarging or contracting at pleasure the communication between the said cylinder and vessel.

250. Machine for Making Hooped Skirts; Cæsar Neumann, City of New York, Assignor to Abraham Prince, Boston, Massachusetts.

Claim—The combination of a series of twisting apparatus with guide rods, for the purpose of forming a hoop skirt. Also, in combination with the twisting apparatus, the elevating screw and its appendages, and the mode of operating the same. Also, collapsing the guides to form different sized skirts, and to deliver the same.

251. "Fifth Wheel" for Fire Engines and other Vehicles; Robert Poole, Assignor to self and G. H. Hunt, Baltimore, Maryland.

Claim—Hanging the pivoted fifth wheel of a steam fire engine, or other heavy carriage, to a bolster when the latter plays within or over the axle of a vehicle, and is suspended to springs which have their bearings or seats on said axle.

252. Meat Safe; E. L. Pratt, Assignor to self and R. B. Fitts, Philadelphia, Pennsylvania.

Claim—A combined arrangement of a cover, perforated with small holes at the upper part, and a stand, also perforated with small holes, as specified.

253. Iron Fences; John B. Wickersham and Henry Jenkins, Brooklyn, New York, Assignor to the New York Wire Railing Company.

Claim—Constructing railways, fences, and other articles, by metallic bars intersecting each other, and united by a cast iron ornament or connexion, when one or more bars running parallel, or in one direction, pass through between two or more bars running in another direction.

254. Mode of Lighting Gas by Electricity; Archilaus Wilson, City of New York, Assignor to D. A. Healds A. L. Wilmarth, C. T. Martin, and H. A. Hurlbut.

Claim—Combining, with a gas or other burner, metallic points approaching but not coming in contact with each other—but this I only claim in combination with the inductive apparatus, for the purpose of effecting ignition by means of the electric discharge or spark. Also, combining with a galvanic battery, an inductive apparatus or coil, metallic points, and an electro-magnet, for the purposes specified.

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255. Machinery for Forming Hat Bodies; Peter Arneson, Newark, New Jersey.

Claim—The arrangement and combination of the adjustable plates, perforated apron, case, feed rollers and pickers.

[The invention consists in disposing, by means of a suction blast and adjustable register, the fur on an endless perforated apron or other carrier, in such a manner that the fur will be presented to the picker and through the latter presented to the cone in a volume varying in density, and corresponding to the varying thickness of the hat body to be formed. It also consists in arranging the former or perforated cone relatively with a picker and discharging rollers, so that the former or cone will receive the fur in proper quantities without the aid of deflectors, guides, or any extraneous device whatever.]

256. Shipper-gear for Pulleys; Albert Betteley, Boston, Massachusetts.

Claim—The combination of a brake lever, a friction roller, and an independent brake, applied and operating together, and with a shipping apparatus.

257. Bed-bottom; R. F. Billings, Portland, Maine.

Claim—The arrangement and combination of the side rails and boxes, provided with the springs, and hinged lids, and slats, attached to the lids by the straps.

258. Bed-bottom; A. Bingham, Talladega, Florida.

Claim—The arrangement and combination of the longitudinal slots, rocking foot rail, rising and falling hand rail, and segment guides.

259. Finger Rings; Seba Bogart, City of New York.

Claim—An extension or divided finger ring having its ends provided with a catch or fastening.

260. Grinding Mills; Charles W. Brown, Boston, Massachusetts.

Claim—1st, Regulating the adjustable stone of a grinding mill that the stone may have a vertical adjustment, so as to grind finer or coarser at the same time, so that the pressure of the runner, with respect to the stationary stone, will be automatically equalized, and be raised and lowered to free itself of any foreign substance getting between the two stones, by means of levers and vertical rod, toggles, sliding collar, and weighted arms, acting upon the movable bearing plate, or the equivalents thereof. 2d, The method set forth for regulating the flow of the grain from the hopper, by adjusting the same vertically. 3d, The dead-eye, arranged within the eye of the upper stone and capable of being raised or depressed with the spindle.

261. Cut-off Gear for Steam Engines; C. P. Buckingham, Mount Vernon, Ohio.

Claim—The employment of the tripper, arranged so as to be adjusted and to trip both valves, in combination with drops, arms, and lifters.

262. Inkstand; William Burnet, City of New York.

Claim—The construction of an adjustable apparatus, connected with the cover and flexible bottom of an inkstand, so that at whatever height (above the lower orifice of the funnel) the link on the main reservoir may be, there shall always be a sufficiency, and never an overflow, in the funnel, on opening the inkstand cover.

263. GRINDING MILLS; J. Carl, Grenada, Mississippi.

Claim—1st, The arrangement and combination of the pivoted lever, shaft, stone, C, and screws. 2d, The employment of a hinged top-bar, in combination with the shaft, and stones, C D.

264. WASHING MACHINE; H. M. Coombs and L. W. Nelson, Portland, Oregon.

Claim—The construction of the clothes' cylinder surrounded with air tubes, having orifices for discharging air into the water, in combination with the drying and washing cylinder and fire chamber.

265. MOLE PLOUGHS; C. W. and J. H. Crandall, and Hoza N. Hawkins, Cameron, Illinois.

Claim—The combination of the opening or ditching piece with the standard and peculiarly formed, hinged follower or former operating in the manner set forth.

266. RAT-TRAP; E. H. Crane, Burr Oak, Michigan.

Claim—The arrangement of the platform, spring, c, strap, spring, i, and chuck, with arms provided with projections, spring, H, and box, provided with hanging door.

267. MANUFACTURE OF RIBBED ELASTIC CLOTH; H. H. Day, City of New York.

Claim—The method of manufacturing ribbed elastic cloth, that is to say, elastic cloth containing strands of rubber, by forming the strands of rubber upon the covering cloth, with which they are to be permanently attached, in contradistinction to forming the strands separately, and afterwards attaching the covering material to them. Also, the method of spreading the gum upon the covering cloth, and dividing it into strands at one process, so that the two operations are effected simultaneously at different parts of the same apparatus.

268. MACHINES FOR WINDING THREAD; Lucius Dimock, Hebron, Connecticut.

Claim—The arrangement and combination with the guide of two separate and distinct series of grooves, having their channels cut on opposite angles.

269. COMPOSITION FOR CEMENT ROOFING; Joseph Ditto and Henry Van Bergen, City of New York.

Claim—The composition prepared and composed of the materials described, in the proportions set forth.

270. NAIL MACHINES; Daniel Dodge, Keeseville, New York.

Claim—A griper, having a reciprocating movement towards and from forging or pointing machinery, and opening automatically at the outer extremity of its stroke, so as to allow the introduction of feeding forward, or removal of the rod, while it is in this position, but holding the rod fast at every other stage of its operation, and while in any other position. And in combination with a so operating griper, I claim the employment of a gauge and a cutter or cutters, operating in the described order of succession with respect to each other and the griper.

271. WRITING FLUIDS; S. W. Eells, Mansfield, Ohio.

Claim—The manner of combining the above materials, so as to prevent the oxidation of the indigo, and the other coloring ingredients, as specified.

272. KNITTING MACHINES; E. S. Ells, Troy, New York, Assignor to C. G. Keeney, Manchester, Connecticut.

Claim—The combination and arrangement of the lever, e, arm, pin, and slot, with lever, l, detent, and springs.

273. ELASTIC BULB SYRINGES; J. J. Essex, Newport, Rhode Island.

Claim—So combining and arranging the bulb, air chamber, and delivery valve with each other, and with the flexible suction and delivery tubes, that the air chamber shall be above the delivery valve, and shall remain while in use, upright, or nearly so, and under the control of the hand which grasps and operates the bulb.

274. BELT FASTENING; Albert Fickett, Rochester, New York.

Claim—The combination of the links with the rivets, said links being inserted in the ends of the belt, in the manner set forth.

275. EASY CHAIR; Elbridge Foster, Hartford, Connecticut.

Claim—The application and insertion of the quadrant slide into the centre of each of the arms or scroll of the side rail, so as to be unseen when the back is up, in the manner described. Also, the application of the spring, adjustable and extension back centre leg, in the manner described.

276. METHOD OF FEEDING THE SAW TO THE STUFF IN SAWING MACHINES; James F. Gamble, Concord, Penna.

Claim—Moving the saw forward when cutting, whilst the lumber is held stationary.

277. HUB-REAMER; Stacy A. Garrison, Union, New York.

Claim—The arrangement and combination of the cutters and the arbor, as described.

278. MACHINE FOR MAKING PAPER BAGS; William Goodale, Clinton, Massachusetts.

Claim—1st, The pasting apparatus, consisting of the roller fitted to work in an opening in the bottom of a paste-box, the spring, or its equivalent, and the adjustable stopper, combined to operate as described. 2d, The combination of the continuously revolving measuring rollers, and the intermittently revolving feed rollers. 3d, The drop, N, operating in combination with the cutter and the feed rollers, as specified. 4th, Folding the paper around a plate or flat piece of any material narrower than the bag itself, or of the same width as, but shorter than, the bag itself. 5th, The folders, applied and operating in combination with the inclined planes at the sides of the folding table. 6th, The combination with the folding table and with a plate narrower than the bag, to fold the bag upon, of one or more movable inclined planes, and creasing blades, operating as described. 7th, The drop, z, applied and operating as described. 8th, The bar, applied to the vibrating roller frame, and operating in combination with the knock-off.

279. POROUS-NAPPED RUBBER FABRICS; Charles Goodyear, New Haven, Connecticut.

Claim—A new porous manufacture or fabric, composed of a woven or other cloth, or equivalent therefor, and india rubber or allied gum, rendered pervious to air and impervious to water, and with a face of flocks, clippings, or shearings, of woolen or other fibres, or equivalents therefor.

280. COOKING STOVES; Rensselaer D. Granger, Philadelphia, Pennsylvania.

Claim—Placing across the upper flue of a cooking stove a hollow box-formed partition, communicating with the external air, the said partition having two openings, arranged in respect to the boiler holes in the top plate, as set forth, and the said openings having their inner surfaces perforated.

281. HARVESTERS; John S. and Rezin Hawkins, Greenfield, Indiana.

Claim—The arrangement of the main frame and team shaft, in combination with the adjustable frame and hinged shoe or cutting apparatus, constructed in the manner described.

282. Screw Presses; Thomas R. Hopkins, Assignor to self and R. E. Robinson, Petersburg, Virginia.

Claim—The use, in combination with a power-screw of a press, or other machine, of two revolving nuts, which are fitted to gear into the thread of said screw, and so arranged and operated upon, in order to give motion to the screw, that the upper one remains stationary while the lower one revolves, and vice-versa.

[This invention consists in giving the follower of a press a progressive upward or downward motion, by means of two sets of cams, with friction rollers between them. The cams are arranged on discs, which have spur-teeth on their circumferences; the upper disc has one more tooth than the lower one. Into these teeth a long pinion gears, said pinion being moved slowly by a long lever, and as it turns, the upper disc gradually gains on the lower one, and, consequently, with the aid of the friction rollers, rises and forces up the follower with a powerful pressure, the gradual elevation being retained at all times by reason of the cams of the lower disc which has no vertical movement, acting antagonistic to the cams of the upper disc which both revolves and moves vertically up and down.]

283. Cooking Apparatus; Robert W. Hill, Naugatuck, Connecticut.

Claim—The portable cooking or heating apparatus composed of the hot air chamber and fire-pit, when provided with ports furnished with registers, with the partition and draft apertures.

284. Marine Propeller; Hermann Hirsch, Berlin, Prussia.

Claim—The peculiar form and construction of a propeller, whereby the centrifugal force obtained is made to co-operate with and increase the effect of the same.

285. Construction of Ships; Hermann Hirsch, Berlin, Prussia.

Claim—The form and construction of the hull of ships or vessels, whereby the possibility of breakage of keel is removed, and a normal form, giving a maximum of steadiness, without retardation of velocity, is imparted to the bottom.

286. Feeding Paper to Printing Presses; Richard M. Hoe, City of New York.

Claim—The combination of the feeding mechanism, cutting apparatus, and the printing machine, or their equivalents, in the said combination for feeding the paper from a roll to a printing machine, and cutting or partially cutting it into sheets, as it passes along to be printed. Also, making the cutter so as to leave the several sheets united in certain places, in combination with the conducting tapes, or the equivalents thereof, so that the conducting tapes may pass around the cutter-cylinder. Also, in combination with the cutter-cylinder and the grooved cylinders, or the equivalents thereof, the employment of the two pressure rollers, or their equivalents, for keeping the sheet distended.

287. Machines for Weighing Grain; Charles H. Hunter, Shelbyville, Indiana.

Claim—The combination of the scale beam or lever with the bag-holder secured to one end, and the standard with rack and pinion for elevating or depressing the scale beam.

288. Harvesters; Obed Hussey, Baltimore, Maryland.

Claim—1st, The combination of the main ground wheel seat and platform, when hinged to the main frame. 2d, The raising and the lowering of the entire frame, finger bar, and outside divider upon the two ground supports, in a horizontal position, by means of a lever and its connexions therewith, operated by the driver from his seat.

289. Mechanism for Protecting the Upper Part of a Boot or Shoe while Applying the Sole; Jacob Jenkins, Lynn, Massachusetts.

Claim—The arrangement of a shoe-jack (or mechanism for supporting the toe and heel parts of a boot or shoe), a guard or protector, the same being made to encompass the upper part of a boot or shoe, or so much of it as extends above the bottom surface of the last, and a clamping contrivance for adjusting the protector to the countour of the shoe. Also, the application and arrangement of an adjustable guard to the protector, whereby the fitting of the outer sole to the insole and upper is not only greatly facilitated, but is rendered certain of being fixed in its true and proper position.

290. Scales; Walter W. Kelley, Reedtown, Ohio.

Claim—The adjustable rack and platform, arranged in combination with the centre-piece upon which the rack and platform are placed, so that either one can be used at pleasure.

291. Pegging Machine; W. R. Landfear, Hartford, Connecticut.

Claim—1st, The employment, in combination with the bar, of the vertically and laterally moving box, having a plate, awl, punch, and inclined face, arranged so that on the descent of the plate the awl will enter the sole, and the inclined face will, while the awl remains in the leather, shove the bar along laterally, thus insuring certainty and regularity of feed; and on the elevation of the plate, the box will be moved laterally by the spring, the awl will be carried over the point where a new hole is to be made, and the punch brought over the previously made peg-hole in readiness to drive home the peg on the next descent of the plate. 2d, The combination with the vertically and horizontally moving box of the spring, for giving a lateral movement to said box, and the adjusting screw for regulating the spaces between the peg-holes. 3d, The arrangement and combination with the bar of the adjustable elastic plate, against which the peg block is pressed, said plate being adjusted by means of the screw to suit any size of pegs.

292. Sleeping Berths for Railroad Cars; D. L. Long, Dayton, Ohio.

Claim—The arrangement and combination of the jointed supporters and hinged seat and back, with the folding berth, screen, and rest, arranged so as to form two sleeping berths, as described.

293. Alloys; Eugene Martin, Waterbury, Connecticut.

Claim—The process or mode of procedure, as applied to the ingredients, such as described.

294. Pumps; John M. May, Janesville, Wisconsin.

Claim—The cylinder, in combination with part, A, arranged and operated with piston and pipe, as described. Also, the screw, D, when used for the purposes of fastening and unfastening the stationary part of the pump in the well or reservoir to any suitable substance, as described. Also, set-screw, N, in combination with the notch or projection, or their equivalents, to form a catch or wrench, for turning the screw, D, and pump nearly in the path of a horizontal circle, in fastening and unfastening the stationary part of the pump in the well or reservoir, the set-screw also serving to gauge the descent of the piston and to protect the valves from injury. Also, the devices consisting of the springs, segment, and lever, connected together, as described.

295. Pumps; John M. May, Janesville, Wisconsin.

Claim—The device for connecting together the cylinders, and regulating the stroke of the pump, in com-

bination with the point or spike, or its equivalent, when used in open wells, and said device in combination rod, when used in drilled wells. Also, the collar and springs, when used in combination with the pump or with the eduction pipe, and arranged as shown.

296. ARGAND GAS BURNERS; Hippolyte Monier, Paris, France.

Claim—The construction of the Argand burner, with its grate and external tube of clay, porcelain, or other incorrodible, refractory, non-conducting material, and with the inner tube and stem of metal.

297. CORRUGATED IRON BRIDGES; Richard Montgomery, City of New York.

Claim—1st, The combination of the corrugated arch, A B, with the corrugated arch, M N, arranged in relation to each other. 2d, The combination of the peculiarly formed blocks, C, and bed-plates, F, with the abutment ends of the arches, A B and M N. 3d, The combination of the blocks, D, and bottom plates, G, with the cross-rails and arches, A B and M N.

298. LADIES' BUSTLES; Benjamin F. Moore, City of New York.

Claim—An inflated bustle for ladies' dresses, formed with the projecting points or scollops, in the manner specified.

299. MODE OF MEASURING GRAIN; Daniel Murray, Fairfield, Connecticut.

Claim—The arrangement of the arms, in combination with the sides, constructed as described.

300. STAMPING MACHINES FOR CRUSHING ORES, &c.; Wm. Murray, Baltimore, Maryland.

Claim—1st, The combination of two or more stampers arranged on the same radial line with two or more semicircular, inclined, revolving, lifting, and dropping cams, which move together, and with a central driving shaft. 2d, Providing the semicircular lifting and dropping cams with a vertical joint about midway between their terminating ends, and with an oblong vertical slot at their rear or highest ends, and attaching said ends, by means of a set-screw, or its equivalent, to the frame of the cams, so that the inclination of said cams may be adjusted to lift the stampers to a greater or less height, according to the force required to perform the operation of stamping.

301. RECIPROCATING SAW; Richard H. Osgood, Columbus, Ohio.

Claim—Providing the upper edges of saw teeth with notches, as described, for the purpose of assisting to clear the kerf of sawdust.

302. HOISTING APPARATUS; John L. Pott, Pottsville, Pennsylvania.

Claim—The inclined drum, revolving in a plane parallel, or nearly parallel, to the lines of hoisting rope, in combination with the guide pulleys on the cross-head, the latter being operated by the shaft or the drum through the medium of the screw, or its equivalent, as set forth.

303. TAPPING WATER MAINS; John B. Quigley, Trenton, New Jersey.

Claim—The employment of the pivoted standards, jaws, adjustable beam, adjustable swivel, chain, vertical sliding piece, and ferule, as described.

304. INKSTAND; Thomas Robjohn, City of New York.

Claim—The arrangement and combination of the ring, D, cover, arm, slatted projection, and diaphragm, so that by pressing down ring D, the cover will open and the ink rise; and by releasing the ring, the ink will fall and the cover will close.

305. METHOD OF SHAPING BONNETS; Charles W. Russell, Philadelphia, Pennsylvania.

Claim—The method of shaping bonnets, &c., by means of a core, or its equivalent, which is wound over the several parts of the bonnet, and which is retained in position by hooks, or their equivalents.

306. MACHINE FOR PRESSING BONNETS; Charles W. Russell, Philadelphia, Pennsylvania.

Claim—The arrangement of the adjustable roller, or its equivalent, in such relation to the chain or rope, which connects the treadle with the press lever, that the direction in which the pressing iron acts can be controlled.

307. ROTARY ENGINES; Augustin P. Samuel, City of New York.

Claim—The method of governing and working the pistons by connecting their piston rods through the roller holders and rollers, directly with the eccentrated curve. Also, the combination and arrangement of the valves with and within the movable pistons, whereby such valves are opened by the first motion of the piston rods, and before any motion is given the pistons, so that a passage is given to the steam within such pistons, and the steam admitted on both sides thereof, for the purpose of producing an equilibrium of pressure on each side of such pistons before they are put in motion. Also, the construction and arrangement of the packing rings acting against each other by inclined surfaces; the outer ring being conical or tapering, on both sides, and the inner ring, being tapering on one side only towards the ring, and the inner ring acting against the other by means of the spring, or its equivalent, expanding it outward against the cylinder, and inward against the piston.

308. MORTISING MACHINE; Hezekiah B. Smith, Lowell, Massachusetts.

Claim—The relative arrangement of the fulcrum, lever, connecting rod, and table, with each other, when combined with power mortising machines.

309. STOVES; George S. G. Spence, Boston, Massachusetts.

Claim—The use of the conical inverted cup, combined with the chain, or its equivalent, in the manner set forth. Also, the combination of the air deflector with the fire-place door register, and so as to operate therewith, and deflect the entering currents of air upon or toward the ignited surface of the fuel.

310. SEWING MACHINES Orange N. Stoddard, Oxford, Ohio.

Claim—The yielding metallic loop-check, operating in combination with a grooved hook, or its described equivalent, in the manner set forth.

311. ANIMAL TRAP; Zuriel Swope, Lancaster, Pennsylvania.

Claim—1st, The sinking bottom, constructed for closing the trap, when acting in combination with the spring and bait lever. 2d, The counterbalance chamber, constructed as described, and operating for the purpose of re-setting the trap.

312. GAS RETORTS; H. K. Symmes, Newton, Massachusetts.

Claim—The arrangement of the removable flues and valves, in combination with retorts of double length.

[This invention consists in arranging the lid of a retort with a horizontal tube or flue in such a manner

that the flue can easily be removed and cleaned independent from the retort, and it further consists in arranging it with a socket to fit to a flanch which is cast, or otherwise rigidly attached to the lower end of the stand pipe, so that the lid can be attached to the body of a retort, dispensing with the mouth-piece altogether; and that the gas emanating from the material in the front part of the retort has to pass back over the hotter portion of the coke in order to reach the opening in the flue through which it passes to the stand pipe, and the stand pipe is secured to the body of the retort, so that its lower end is open when the door is taken off. If this arrangement be applied to retorts of double length, the openings of the flues are closed by valves which are operated from the outside, and the two ends of the retorts are closed at different times, so that one end is hot while the other is charged, and by closing the flue on this end, the gas arising from the fresh charge can be forced to pass through the whole length of the retort to the flue on the opposite end.]

313. TICKET-HOLDER FOR RAILROADS, &c.; Charles Taylor, Little Falls, New York.

Claim—The eye, spring clasp, and spring hook, in combination with the link, or its equivalent.

314. PREPARATION OF CANDLEWICKS; Stephen R. Weeden, Providence, Rhode Island.

Claim—A plaited or braided candlewick, saturated with a solution of acetate of lead, or other substance, to aid combustion, and coated with a silicate, as and for the purpose set forth.

315. RAILROAD CHAIRS; J. W. Wetmore, Erie, Pennsylvania.

Claim—The T lip or jaw, notching the web of the rail, and through these notches, having the bottom of the jaw pass down, and riveted or keyed under the base.

316. WATER-WHEELS; Ira Wisel, Newbury, Minnesota.

Claim—The peculiar form of the buckets, in combination with the rest of the wheel.

317. KNITTING MACHINES; F. L. Buel, Assignor to C. G. Keeney, Manchester, Connecticut.

Claim—Attaching the mechanical device, above set forth, to a knitting machine, namely, by the thread guide, lever, c e, and arm. Also, the arrangement of the lever, k, connexions, frame, and arm, as described.

318. SEWING MACHINES; Jonas Hinkley, Assignor to self and Frederick A. Wildman, Clarksfield, Ohio.

Claim—1st, The combination of the looper and receiving spring hook, arranged in the manner set forth. 2d, The combination of the deflecting hook, the looper, and the receiving hook. 3d, The lifting finger, or its equivalent, operating as set forth. 4th, The combination of the lifting finger with the looper and receiving hook, as described. 5th, The combination of the lifting finger, the deflecting hook, the looper, and the receiving hook, as described. 6th, The combination of the arm, link, and lifting bar, with the vibrating bar and feeding hand, for the purpose described.

319. CAM PRESSES; Thomas R. Hopkins, Assignor to self and R. E. Robinson, Petersburgh, Virginia.

Claim—Operating a press follower, or other part of a machine which is required to give a gradual pressure, by means of the combined agency of two differentially toothed discs, which revolve at unequal speeds, two sets of reverse acting cams and intermediate friction rollers, or their equivalents.

320. MACHINERY FOR MAKING CLAY PIPE; Wm. Linton, Assignor to self and John Jones, Baltimore, Md.

Claim—The two-sized permanent core or mandrel, in combination with the fixed die and adjustable jaws, arranged in the manner described.

321. QUARTZ MILLS; E. T. Steen, San Francisco, Assignor to self and B. S. Nichols, Sacramento, California.

Claim—The employment of stampers, operated by means of steam cylinders, which communicate by the cross-passage, the change of steam being effected by valve pistons operating on a working beam, and operated by the pistons.

322. MANUFACTURE OF IRON; Bernard Louth, Assignor to Jones & Louth, Pittsburgh, Pennsylvania.

Claim—Rolling iron or steel in a cold state for hardening and adding strength to it, without injury to its fibre, and at the same time reducing it in size.

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323. LOZENGE MACHINES; Edmund Belling, City of New York.

Claim—The combination of a revolving or reciprocating knife with the lower part of a press, and operated simultaneously with the same, in the manner described.

324. HORIZONTAL WATER-WHEEL; Abraham Andrews and Harrison Kalbach, Bernville, Pennsylvania.

Claim—The curved concave buckets, having curved or eccentrically formed tops and bottoms, in combination with a spiral water-way or chamber underneath, and arranged within a box, as described.

325. ARTIFICIAL LEGS; Douglas Bly, Rochester, New York.

Claim—1st, The combination of the segment of rubber, or its equivalent, with the foot and leg, in the manner described. 2d, Connecting the foot to the leg, by means of the cord, or its equivalent, thereby dispensing with all joints, bolts, hinges, and metal straps, and the friction and noise to which they give rise.

326. ELASTIC HOSE TUBING; J. C. Boyd, Boston, Massachusetts.

Claim—The hose made of flexible tubes, the same consisting of a woven fabric of cotton, hemp, or other fibrous materials, lined with or fastened to a layer or sheet of india rubber or gutta percha, or any other water-proof composition, and the whole secured by rivets.

327. IRON TIES FOR COTTON BALES; William Boyd, New Orleans, Louisiana.

Claim—In combination with the splits, the use of a key, having wings at each end, to form the lock to the tie, arranged as set forth.

328. TANNING; Jehu Brainerd and W. H. Burridge, Cleveland, Ohio.

Claim—The improvement in tanning set forth, consisting in the immersion of the skins and hides in a tan liquor made from the digestion of the before-mentioned plants, and the accompanying treatment of the skins and hides, by their immersion in the preparing liquid, the whole process being conducted in the manner set forth, whereby the valuable properties of the plants may be preserved for use—and this we claim, whether the above described tan liquor be used separately, or in connexion with other substances containing tannin.

329. GOLD AMALGAMATORS; Henry Brevoort, San Francisco, California.

Claim—The drag, having upon its lower surface or shoe the combination of the blocks of rubbing sur-

faces and channels, the two being arranged reciprocally in the manner described. Also, combining with a revolving drag, a pan, whose bottom is inclined, and has the form of a circular trough, so as to collect the mercury in mass. Also, combining an amalgamating pan and revolving drag with a galvanic battery, arranged in such manner that its poles are extended into the mass of material in the pan, and that the parts of the material are subjected in succession to the action of the galvanic current. Also, the employment of a solution of the nitrate of mercury in connexion with a galvanic battery and a friction amalgamator containing mercury.

330. QUARTZ-CRUSHING MACHINES; Henry Brevoort, San Francisco, California.

Claim—The relative arrangement and combination of the curved grinding shoes, having their front edges beveled and inclined backwards from their outer corners, and caused to revolve so as to gather in and return the coarser fragments towards the centre of the series. Also, the arrangement and combination of a series of grinding shoes, with their front edges curved or inclined backwards, with a corresponding inner series of reducing shoes, so that the coarser fragments are re-delivered in an inward direction to the reducing shoes, while the grinding and outward movement of the fine particles proceed continuously.

331. GUN LOCK; William Briggs, Norristown, Pennsylvania.

Claim—Constructing the stock and breech of the barrel, so as to be susceptible of and united to each other by the tang or breech-pin and tapering screw-pin, and the spring hammer-guard and trigger, arranged and combined with the stock, in the manner set forth.

332. WATER METRE; B. S. Church, Manhattanville, New York.

Claim—1st, The arrangement of a drum with the chamber and buckets, in combination with the trough and air chamber, and operating as set forth. 2d, The arrangement and combination of the trough, the pipe, the chamber, the air chamber, and the drum, to operate as specified.

333. CARRIAGE SPRINGS; H. S. Clark, Wyalusing, Pennsylvania.

Claim—The arrangement and combination of the U-shaped leaves with the elliptical springs, so that the extremities of the leaves will approach each other, and will be secured to the centres of the springs.

334. WASHING MACHINES; F. J. Crissey, Leesburg, Virginia.

Claim—The arrangement of frame, supports, i i, upright shaft, rollers, supports, c c c, and collar, in combination with the bottom of the tub, arranged as set forth.

335. VALVE FOR STEAM ENGINES; Addison Crosby, Fredonia, New York.

Claim—The employment, as an induction or eduction valve in a steam engine, of a rolling or oscillating valve, composed of two segments, having their faces eccentric to its axis of oscillation, and with an opening between the segments.

336. ELASTIC CLOTH; Horace H. Day, City of New York.

Claim—The new elastic cloth, consisting of stockinet cloth, elastic gum, and flock, combined so that the elastic gum is covered on one side by the stockinet, and so on the other by the flock.

337. SCROLL-SAWING MACHINE; Samuel De Vaughan, Washington City, D. C.

Claim—The vertical plates, g, and guide blocks, plates, m and m', and guide arm, for the purpose of a compound guide. Also, the manner of operating link on bearing, in combination with block and guide arm, for the purpose set forth.

338. HARVESTERS; J. A. Falk, Andrew Johnson, and G. A. Erickson, Altona, Illinois.

Claim—The arrangement of the wheel, which is provided with the pin near its periphery, with the bar and pulley, constructed for the purpose of operating the band which drives the endless belt.

339. OPHTHALMIC VAPOR APPARATUS; T. F. Frank, Ischua, New York.

Claim—The ophthalmothological vapor bath, constructed and operating as described, for producing medicated vapor.

340. FAUCETS; Albert Fuller, Cincinnati, Ohio.

Claim—Encasing an elastic plug valve in the above described metallic shield, for the purpose set forth.

341. MACHINE FOR CUTTING AND SCREENING BITUMINOUS LIMESTONE OR ASPHALT; Quincy A. Gilmore, City of New York.

Claim—1st, The rotary cylinder or drum, carrying knives or cutters of the form described, arranged in rows, either with or without the raised bands, or in rows parallel or oblique to the axis of the cylinder, for cutting asphalt, sometimes known under the name of bituminous limestone. 2d, The application of the machine as a whole, to the purpose of cutting and screening asphalt or bituminous limestone.

342. CORD GUIDES FOR SEWING MACHINES; A. Golay, Mobile, Alabama.

Claim—The arrangement and combination with the adjustable plate, of the groove and guides, so that the cord may be guided and conducted between two or more thicknesses of cloth.

343. FLOUR BOLTS; Elias Graham and I. N. Patton, Elizabethtown, Kentucky.

Claim—The combination of the wedged sliding ribs with the rods and screws for adjusting the same, in the manner set forth.

344. BILLIARD CUE-TIP; J. H. Green, Christiansburg, Iowa.

Claim—A tip or point for billiard or bagatalle cues, made of any compound described, so as to dispense with the external application of chalk, or other substance, to the point of the cue.

345. HOLLOW GRATE-BAR FOR STEAM BOILERS; Benjamin L. Griffith, Reading, Pennsylvania.

Claim—Two or more tubes attached to hollow boxes connected to the fire-box, by means of hollow perforated screw plugs, and arranged in sets to complete the grate.

346. BREECH-LOADING FIRE ARMS; Henry Gross, Tiffin, Ohio.

Claim—1st, Giving the chamber its longitudinal motion upon a bed-piece, which remains fixed during such motion, and in revolving carries with it the chamber. 2d, The roller, or its equivalent, upon the cheek-piece, and its combination with the groove. 3d, The double eccentric head of the lever, when connected with the chamber and bed-piece. 4th, The adjustable bearing piece for the eccentric of lever.

347. FASTENING FOR HOOP SKIRTS; Albert W. Hale, City of New York.

Claim—The method of connecting and fastening the ends of the hoops by means of the cap, one part of such cap, with the end of the hoop, forming a point or extension to enter a recess in the cap on the other en

of the hoop; and such cap also furnishing the recess to receive the said points or extension of the other end of the hoop, when the cap and hook are bent, in the manner described.

348. ESCAPEMENT FOR CHRONOMETERS; William W. Hammond, City of New York.

Claim—The employment of the hollow semi-cylinders on the vibrating lever, in combination with the escapement wheel, and the balance and verge. Also, in combination with the escapement, as described, or any equivalent therefor, the employment of the holding spring.

349. SEWING MACHINES; James Harrison, Jr., City of New York.

Claim—1st, The combination of the frame or feeding lever, j, bar, m, spring, o, and regulating screw, p, with the needle and needle frame for carrying the mechanism for rotating the needle. 2d, The adjustable bar or band affixed to the lever or frame, J, in combination with the frame, i, for controlling the upward movement of the feed lever. 3d, The bar or band, in combination with the bar, m, screw, p, spring, o, and lever, j.

350. BED-BOTTOM; Royal Hatch, Strafford, Vermont.

Claim—The arrangement of a central supporting bar with a sacking, both provided with double loops, and attached respectively to the bedstead.

351. SPRINGS FOR RAILROAD CARS, &c.; Alexander Hay, Philadelphia, Pennsylvania.

Claim—1st, The construction of vulcanized india rubber springs, in which the threads, or warp, or fabric out of which they are formed, is made non-elastic before it is woven or knit. 2d, In combination with india rubber springs, to be acted on by tension or stretching, I claim the tubes with their flanches. 3d, In combination with the springs, acting as described, I claim the supporter with the opening in each end, and holes for tightening the spring.

352. METALLIC RAZOR-STROP; Milo A. Holcomb, Granby, Connecticut.

Claim—A razor-strop made of polished steel of the requisite degree of hardness, when possessing a sufficient degree of flexibility to enable the angle at which its surface forms with the edge of the razor to be lessened to the desired extent.

353. MACHINERY FOR WINDING WARPS UPON THE BEAM; Daniel Hussey, Nashua, New Hampshire.

Claim—The peculiar combination for maintaining uniformity of wind, or surface speed of wind, on the yarn beam, the same consisting of the friction wheels, the lifter rack, the pinion, and the compound motion mechanism, or their mechanical equivalents, applied to the yarn guide rollers, and the mechanism for adjusting the yarn beam, in manner specified.

354. FURNACES FOR SMELTING ZINC ORES; Joseph and Isaac Kalbach, Bernville, Pennsylvania.

Claim—Constructing the crucible with a detachable bottom, and attaching it to the arch of the cylinder or collar and to the bed-plate, by the rings or annular plates, whereby we are enabled to empty the crucible at its bottom, and to remove the entire crucible through the bottom or the arch of the heat chamber, as may be required.

355. MACHINES FOR HOLDING STONES; Ebenezer B. Knight, Malden, New York.

Claim—Providing the stone-holding machine with the suspending arms, plates, rod, and adjusting bolts, or their equivalents, whereby said machine may readily be adjusted vertically and also horizontally, in the arc of a circle.

356. WIND-MILL; Charles Livingston, Redwood City, California.

Claim—The cowl, with tubes and wheel combined and arranged for joint operation, as set forth.

357. CHUTE FOR HORIZONTAL WATER-WHEELS; Isaac Mallory, Etna, New York.

Claim—Constructing and arranging the scroll within the penstock, so that it can be turned, so as to partially close the orifice for the admission of water upon the buckets, and to thereby regulate the flow of water for any head, or for any quantity of water.

358. CURING AND TREATING CAOUTCHOUC; E. E. Marcy, City of New York.

Claim—The improved process of curing india rubber by combining with the sulphuret of lead and carbonate of lead, or the protoxide of lead, in the manner hereinbefore described, and without the use of free sulphur, in combination with the rubber or with said compound, and the exposure of these compounds to steam or water at the temperature hereinbefore stated, and in the mode pointed out.

359. CURING AND TREATING CAOUTCHOUC; E. E. Marcy, City of New York.

Claim—The improved process of curing india rubber by combining it with the sulphuret of zinc and the hyposulphite of zinc, in the manner hereinbefore described, and subjecting the compound to steam and water, at the temperature stated, without the use of free sulphur, in combination with said compound.

360. CURING AND TREATING CAOUTCHOUC; E. E. Marcy, City of New York.

Claim—The improved process of curing india rubber, and producing an improved article of india rubber, by combining india rubber with the hyposulphite of zinc, in the matter hereinbefore described, and without the use of free sulphur, in combination with the rubber, or with said compound, and the exposure of this compound to steam or water, at the temperature hereinbefore stated, and in the mode pointed out.

361. MACHINES FOR PICKING MILL-STONES; R. D. Nesmith, Franklin, New Hampshire.

Claim—The spring upon rod, provided with head for limiting the extent of its action upon the picks, as arranged with the inclined plane and cam, and the operating parts with which they are connected, in the manner specified.

362. APPARATUS FOR MANUFACTURING ILLUMINATING GAS; Samuel Nowlan, City of New York.

Claim—The gas exhaust and expelling wheel, interposed between the retort and the condenser, so as to operate in the manner set forth.

363. APPARATUS TO PHOTOGRAPH ON UNEVEN SURFACES; John H. Pein, Hoboken, New Jersey.

Claim—Photographing on vases, or other uneven solids, by means of an apparatus herein described, and in the manner set forth.

364. GELATINIZING OILS; Edmund Queru, City of New York.

Claim—The jellification of castor oil by means of the process described.

365. TINMAN'S MACHINES; Charles H. Raymond, Southington, Connecticut.

Claim—The movable and adjustable stand and its revolving box, when combined with shaft, cap-plate, and screw, in the manner described.

366. FURNACE AND VENTILATOR; Charles B. Sawyer, Fitchburgh, Massachusetts.

Claim—Providing the fire-pot with a series of small holes or openings, as set forth.

367. ORE CONCENTRATOR; Edward L. Seymour, City of New York.

Claim—1st, The rotating sieve, in combination with the bellows, or their equivalents, operated by the act of rotation of the former. 2d, The application of two or more rotary sieves, combined with such an arrangement of "waste tubes," that the refuse of the upper sieve shall be led to constitute the supply or feed of the sieve next below it. 3d, Rendering the receiving mouths of the "waste tubes" adjustable. 4th, The use of the closed chambers or "traps" below the sieves, as described.

368. COMPOSITION FOR DESTROYING INSECTS INJURIOUS TO FRUIT TREES; Philo B. Sheldon, Prattsburgh, N. Y.

Claim—Combining and employing the ingredients herein described, in substantially the mode and proportions set forth, for the purpose of destroying borers, and other insects on fruit trees.

369. LETTER FILE; J. H. Shipman, Yorkville, New York.

Claim—The arrangement of the movable hinged guards, in combination with the metal back and points, as described.

370. HOSE COUPLING; William H. Smith, Newport, Rhode Island.

Claim—The hose coupling described, made by combining the open spiral flanch with a screw, as set forth.

371. STOVE URNS; James Spear, Philadelphia, Pennsylvania.

Claim—The arrangement of the register in the base of the urn, with the ornamental receptacle for the cup, constructed in the manner described.

372. CHURNS; A. L. Sperry, Auburn, Indiana.

Claim—The arrangement of the hook and button, to operate in combination with the dasher and breaker frame, in the manner specified.

373. ROTARY PLANING CUTTER; Henry D. Stover and J. W. Bicknell, Boston, Massachusetts.

Claim—The adjustable revolving guard, as constructed and connected adjustably to the cutter head, carried by and having all its movements to effectually protect the operator from mutilation, and to hold down the material receiving shape, in the manner set forth.

374. STONE SAWS; Peter Sweeney, Buffalo, New York.

Claim—The employment of two plates, in combination with the dish-formed cutter, arranged as described.

375. SHINGLES; Joseph Sweetser, Biddeford, Maine.

Claim—The fluting of the shingles.

376. AUGER FOR CUTTING ROUND TENONS; George Taylor and George H. Burger, Worthington, Ohio.

Claim—The arrangement and combination of the spring with the shank and tube, as described, whereby the plug is rendered self-acting.

377. FEED-WATER APPARATUS FOR STEAM BOILERS; Joseph B. Thompson, Warrenton, Georgia.

Claim—The exterior water chamber, communicating with the supply tank by pipe, and with the boiler by force pump and pipe, and provided with a valve, in combination with the peculiarly constructed float, rods, and lever, operating as specified.

378. FIRE-PLATING IRON; William H. Thoss, San Francisco, California.

Claim—Preparing the iron after it has been cleaned with dilute acid, by immersion in a solution of borax, and after being dried, passing it through the molten copper, maintained at the required heat in a furnace, constructed with a roof to concentrate the heat over the basin of molten copper, and with an aperture at one side to insert the iron to be plated, and a corresponding one on the opposite side, to receive the iron as it is drawn from the copper plate, as described.

379. HEMP BREAKES; William A. Vertrees, Winchester, Missouri.

Claim—Constructing the rocking breaker frame of hemp or flax breakers, in the manner described, and operating it by means of a slotted pitman, in such manner as that while the vibratory motion is communicated from the prime motor to the breakers by machinery, yet they fall on the hemp or flax with a free stroke or flail motion.

380. SHINGLE MACHINE; Nathaniel Waterbury, Fond du Lac, Wisconsin.

Claim—1st, The reciprocating bolt carriage, tilting beds, circular saw, and sliding jaws, arranged relatively with each other as shown, and operated respectively by the cam, cam ratchets, and pendants, belt, and levers and weights. 2d, In connexion with the reciprocating belt carriage, saw, and tilting beds, the bar, provided with inclined slots, and connected with the frames of the jaws, by means of the pins fitting in said slots for the purpose of elevating the bolts during their return movement. 3d, The employment or use of the cam ratchets attached to the framing, in connexion with the pendants attached to the reciprocating bolt frame, arranged for automatically tilting the beds.

381. MACHINE FOR COILING METAL PIPE; Peter L. Weimer, Lebanon, Pennsylvania.

Claim—1st, The coiling cylinder with the peculiar shaped groove, arranged as described. 2d, The arrangement of the two guide wheels, triangular piece, and shaft, when used in combination with the coiling cylinder, and for the purpose described. 3d, The movable plate and jack-screws, for the purpose of adjusting the guide-wheel shaft to any angle required.

382. SKATES; Asa Wheeler, Brattleboro', Vermont.

Claim—The arrangement and combination of the adjustable heel-piece, heel-case, stock, screw, and front straps, as described.

383. FEED-WATER HEATERS FOR STEAM BOILERS; John M. White, City of New York.

Claim—The arrangement of the division chamber, supply and discharge pipes, and heating pipes, placed within the exhaust side pipe, in combination with the relief pipe, by which, when necessary, the water may be passed directly to the boiler without being passed through the heating pipes.

384. HARVESTERS; Abner Whitely, Springfield, Ohio.

Claim—1st, So arranging the mechanism of the automatically operating door or shutter, for preventing scattering and admitting the gavels to be discharged at regular intervals, as to permit the attendant to increase the intervals of time for the discharge of the gavels where the grain is thin upon the ground. 2d, The

combination of the rake with the door or shutter, for discharging the gavel at the time the door or shutter is opened for the purpose, whether it is at regular intervals or less frequently.

385. SHEARS FOR SEPARATING PAPER; Jeptha Avery Wilkinson, Brooklyn, New York.

Claim—1st, Separating paper, or other material, by the joint operation of a revolving shear and a stationary surface, when said stationary surface is so formed and placed as gradually to approach the path described by the shear in its revolution, and compress the said paper, or other material, on to the edge of said revolving shear, in the manner specified. 2d, The elastic roller or rollers, in combination with the stationary surface and revolving shear on the cylinder, whereby the paper is passed through and separated progressively as at two operations. 3d, The arrangement of the shaft carrying the rollers, the springs, and cams, for elevating the rollers and preventing traction on the paper.

386. TURN-OUTS FOR RAILWAYS; Frank C. Brown, Assignor to Wm. Brown, Philadelphia, Pennsylvania.

Claim—The addition of grooves on the circumference of car wheels, as now constructed, with a single flanch and tread, and the placing of curved bars at turn-outs on the track of the road, to enter and operate on such grooves for the purpose of changing the direction of cars.

387. MACHINERY FOR HARDENING HAT BODIES; Seth Boyden, Assignor to self and H. H. Jacques, Newark, New Jersey.

Claim—1st, The employment of a cloth, or its equivalent, in combination with a cone, in the manner described. 2d, The arrangement and combination of the frame, shaft, J, eccentrics, h′, rods, i, tubes, arms, shaft, K, eccentrics, p, rods, q, bars, cloth, so that the cloth will be operated with a compound movement.

388. ROTARY HARROWS; William P. Goolman, Assignor to self, S. B. Morris, and Wm. Hollingsworth, Dublin, Indiana.

Claim—1st, The described application of friction rollers between rotary concentric harrows, to elevate opposite sides of the respective harrows. 2d, The reversible arm, arranged between concentric harrows to change the direction of the rotation of the said harrows. 3d, The reversible bent spindle, adapted in the manner set forth, to correspond with the relative obliquity of two concentric harrows. 4th, The described arrangement of the friction rollers and adjustable washer on the arm, operating in the manner set forth, to vary the relative obliquity of the harrows.

389. WRENCHES; Daniel G. Greene, North Bridgewater, Assignor to self and William Nash, South Weymouth, Massachusetts.

Claim—The combination of the movable jaw, inclined shoulders, U, with the pawl and inclined shoulders, V, and enlarged hole, and ratchet teeth, arranged in the manner set forth.

390. SHEARS; Michael Irion, Utica, Assignor to self and Jacob Heidel, Oneida County, New York.

Claim—The combination of the cutting plates, the circular punch, and the circular die, to receive the punch, and surrounded by a cutting edge, in connexion with a pair of movable jointed arms, arranged in the manner set forth.

391. LAMPS; George Marlow and Michael Ralphe, Assignors to A. D. Brown, U. C. Valette, and George Marlow, Cincinnati, Ohio.

Claim—1st, The arrangement of the separate cup-formed back reflector upon the inside of the door, with an open-backed parabolic or conical reflector. 2d, The described arrangement of glazed doors, M and M′, hinged vertically to the front angles of the lantern, and adapted in the manner set forth, to be fixed either in front of the lantern or against one or other of its sides.

392. PIANO-FORTE ACTIONS; Theodore Marschall, Assignor to Lighte & Bradbury, City of New York.

Claim—The spring-supporting post, when used in the described combination with a stud, separate and distinct from the moving parts to detain the hammer at any determined height, while the jack descends sufficiently to re-engage beneath the hammer butt.

393. CHURNS; E. L. Pratt, Assignor to self and R. B. Fitts, Philadelphia, Pennsylvania.

Claim—In combination with the rotary case or body of a churn, a diaphragm or piston, adapted both to move upon and be moved by a screw shaft, or its equivalent, placed horizontally in the said case, as described, the said diaphragm and shaft being constructed as set forth. Also, the series of perforatons through the diaphragm or piston, in combination with the movable perforated adjusting disc or plate, or their equivalent, the same operating together in the case, as described.

394. COTTON GINS; Wm. F. Pratt, Assignor to the E. Carver Company, East Bridgewater, Massachusetts.

Claim—The use of a naked or unshielded auger or cleaver, operating in the end of a ginning roll of a cotton gin at or near the centre thereof, in the manner described.

395. GRAIN-BINDING MECHANISM; Allen Sherwood, Assignor to E. P. Lenter, A. H. Goss, Wm. Hills, and Ameretta Sherwood, Auburn, New York.

Claim—The combination of the shield and lever, both removable and located at one side of the delivery portion of the platform, so that the shield shall protect the lever from the cut material, and from one side of an open-ended grain receiver (the fence forming the other side thereof), where the grain is deposited previous to being bound. Also, in combination with the raker's stand and binder's seat, the shield and lever, so arranged that the raker, from his stand, may sweep the cut grain into the receiver, and the binder, from his seat, reaches beyond the receiver to catch the lever. Also, in combination with the grain receiver, the inclined ledges, under which the wire is passed, so as not to catch or interfere with the entrance of the grain therein. Also, the slot and flanches in the shield, said flanches serving as a guide for properly bringing down the foot of the lever to insert the wire in the twisting wheel. Also, in combination with the lever, the clamp, located in close proximity to the handle, so that the binder, as he draws up the gavel, may check the paying-out of the wire, and thus bring it tightly around the bundle. Also, the combination of a removable shield and lever, on the platform, with a removable twisting mechanism on the fence or side of the platform, for the purpose of adapting an ordinary hand delivery mowing machine into a self-binder, or vice-versa, without in any manner altering the parts which enables it to be so exchanged, except to attach or detach them, as set forth.

396. NAIL MACHINES; Daniel Dodge, Keeseville, New York.

Claim—The combination of an anvil and fixed die, or other equivalent fixed surfaces, a roller, hammers, and a vibrating guide. Also, the operation of a hammer, in combination with the roller and anvil, by means of an eccentric on the roller shaft, and a universal joint at the connexion of the hammer with the connecting rod of the eccentric.

Disclaimer.

1. Gas Burners; William Blake, Boston, Massachusetts; patented August 9, 1845; disclaimer filed August 5, 1859.

I hereby enter my disclaimer to that part of said burner which was set forth and claimed as the "bell shape or mouth of the lower part of the inner case of said burner."

Extensions.

1. Gas Burners; Wm. Blake, Boston, Massachusetts; patented August 9, 1845; extended August 9, 1859.

Claim—The combination with the space directly beneath the orifices of discharge of the gas, and with the supply or branch tubes, an expansive chamber, so as to operate in the manner set forth. Also, making the lower part of the inner case of the burner with a bell-shaped opening or mouth, in the manner specified.

2. Grinding Mills; Beriah Swift, Washington City, D. C.; patented August 16, 1845; extended Aug. 16, 1859.

Claim—Making the grinding teeth of mills, in concentric rows, projecting from the surface of the plates, so that the teeth of one plate shall run in the spaces between the teeth on the other, and vice-versa, in combination with the grooves or furrows running towards the periphery of the plates, through which the substances acted upon are carried outwards, whether these furrows be arranged radially according to what is technically termed the eight quarter dress, or in any other manner leading from the inner to the outer range of teeth. Also, in combination with the teeth arranged as expressed in the above claim, the breaking the teeth on a cylinder or cone, arranged as described.

Additional Improvements.

1. Ploughs; George Watt, Richmond, Virginia; patented February 9, 1858; additional dated Aug. 2, 1859.

Claim—The combination of the eccentric roller, beam, notches, and cuff, substantially as set forth.

2. Lock; A. A. Richards, Urbana, Ohio; patented Feb. 15, 1859; additional dated August 9, 1859.

Claim—The arrangement of the spring, collar, ring, screw, brake-wheel, and arbor, in the manner described, so as to produce friction between the ring, and wheel, and arbor, and also the arrangement of the brake, indented flanch, and stem, so as to prevent the revolution of the wheel, and arbor, and ring, and the external dial hand.

3. Instruments for Taking Altitudes of the Sun; Frederick Yeiser, Lexington, Kentucky; patented Feb. 8, 1859; additional dated August 9, 1859.

Claim—In combination with the rotary bar, the arrangement of the adjustable bar and dial plate, and rotary cylinder, and adjustable disc, in connexion with the bar, k, and plates, a a, holding the lens, and having on its face a small square to receive the sun's image through the lens, in such relation to each other and to the rotary bar, that it operates as specified.

4. Mole Ploughs; Moses Bales, Big Plain, Ohio; patented Feb. 15, 1859; additional dated Aug. 23, 1859.

Claim—The employment of the cap, in combination with the mole, arranged as set forth.

5. Apparatus for Evaporating Saccharine Juices; L. P. Harris, Mansfield, Ohio; patented Jan. 18, 1859; additional dated August 23, 1859.

Claim—The application of partial, transverse, or oblique partitions to evaporating pans, for the purpose of preventing a continuous transverse channel, arranged in the manner described.

6. Mode of Oiling Journals; Douglas B. Jordan, Cumberland, Rhode Island; patented March 15, 1859; additional dated August 30, 1859.

Claim—1st, The hinging the dish or bucket to the rod, as set forth. 2d. The dish or bucket, in combination with the several parts marked C D E F and I, for the purpose set forth and described.

Re-Issues.

1. Balancing Mill-stones; John Fairclough, Louisville, Kentucky; patented Dec. 21, 1858; re-issued Aug. 2, 1859.

Claim—The employment or use of weights placed within boxes or recesses in the back of the stone, and arranged so that they may be adjusted vertically, and more or less be used in each box or recess to admit of the balancing of the stone or runner, both while in motion and at rest.

2. Nail Machine; Jahaziah S. King, Raynham, Massachusetts; patented October 20, 1857; re-issued August 2, 1859.

Claim—Making cut nails in such a manner that each nail will be seized the instant after it is cut from the nail plate, and be compressively operated upon at the point thereof, in the manner specified, to bring the flat point of said nail plate to an equal-sided sharp point, or to substantially the same character of point that is ordinarily given to wrought nails.

3. Machine for Matting the Ends of Match Blocks; Henry E. Pierce, Charlemont, Massachusetts; patented Jan. 10, 1854; re-issued August 2, 1859.

Claim—Matting the ends of match blocks by pressure of a roller or rollers, for the purpose set forth, and in this claim I wish to be understood that I do not confine myself to the precise arrangement of the parts described, but shall vary them at pleasure, while I attain the same ends by means substantially the same.

4. Clothes Dryer; Stephen H. Tift, Morrisville, Vermont; patented July 20, 1858; re-issued Aug. 2, 1859.

Claim—The combination of the slotted, perforated hub, and slotted, bored cap-hub, with the arms and braces connected with the hubs by wires, as described, and the arrangement of the same with the shaft, collar, and ratchet catch.

5. Ploughs; George Watt, Richmond, Virginia; patented Feb. 9, 1858; re-issued August 2, 1859.

Claim—Constructing mould-board and land-side of cylindrical surfaces of equal diameters, intersecting along the cutting edge of the plough, in combination with the standard curving landward from the top of the mould-board to a position nearly over the base of the land-side.

6. BREECH-LOADING ORDNANCE; G. W. Bishop, City of New York; patented March 8, 1859; re-issued August 16, 1859.

Claim—Combining the movable breech-pin with the bore of the cannon, by means of movable locking or abutting pieces or segments, and which, after the breech-pin is inserted, are shifted and made to cross the joint of the breech-pin and bore, to hold the breech-pin against the force of the discharge.

7. ASH-SIFTERS; Allan Cummings, City of New York; patented March 8, 1859; re-issued Aug. 16, 1859.

Claim—The employment of a conical sieve, or sieve of an equivalent form, in combination with the two receptacles, one for the sifting and the other for the substances sifted. Also, the conical deflector for deflecting the substances to be sifted, and concentrating them in combination with the spreader, whether the spreader be itself the sieve or employed with the sieve below. Also, in combination with the sieve, the under conical surface of the deflector for preventing the escape of dust from the apparatus. Also, in combination, the deflector, the spreader, the conical sieve, and the receptacles for the siftings and the substances sifted.

8. SASH-FASTENER; Ralph J. Falconer, Washington City, D. C.; patented August 31, 1858; re-issued August 16, 1859.

Claim—Extending the cap portion of the catch over and along the front edge of the catch-plate, to form a catch-opening flush with the edge of plate, so that the window cannot be unfastened without having the point of the hook withdrawn entirely clear from the meeting rail of the upper sash, and out of the way of the bars above when the lower sash is raised. Also, in combination with the catch, hook, and plate, I claim the check, or equivalent thereof.

9. VALVE COCKS; J. R. and H. S. Robinson, Clinton, Massachusetts; patented Aug. 31, 1858; re-issued August 16, 1859.

Claim—1st, The method of constructing valves, valve cocks, and gates, so that, when the port or ports therein are uncovered, there shall be a straight passage or passages from the induction port or ports in the valve chamber to the eduction port or ports in the same, whether the valves in such valves, valve cocks, and gates, are made in one or more than one piece. 2d, Making the valves in valves, valve cocks, and gates, in separate or detached pieces.

10. MACHINES FOR MAKING PAPER BAGS; Francis Wolle, Philadelphia, Pennsylvania; patented July 6, 1858; re-issued August 16, 1859.

Claim—1st, The combination of the creaser and lappers, arranged and operating in the manner described. 2d, The folding of a lap in the manufacture of a bag of paper, or other material, by means of a creaser blade and two rolling surfaces, operating in combination with each other. 3d, The revolving lapper shaft, in combination with the creaser, the feeding roller, and aprons, the creaser being brought into operation on the lap during the intermission in the motion of the feed rollers.

11. TREATING CAOUTCHOUC AND OTHER VULCANIZABLE GUMS; Conrad Poppenhusen, City of New York, Assignee of L. Otto P. Meyer, Newtown, Connecticut; patented April 4, 1854; re-issued August 16, 1859.

Claim—The mode of operation, as described, which said mode of operation consists in the employment of a pliable or flexible envelope, or the equivalent thereof, applied by pressure to the hard compound of vulcanizable gum, while in the green or plastic state, so as to insure the contact of such covering with the surface of the compound, and while thus covered or protected, subjecting it to the vulcanizing heat, and when vulcanized, stripping off such covering.

12. REFINING IRON IN THE HEAT OF A BLAST FURNACE; Christian Shunk, Canton, Ohio; patented May 17, 1859; re-issued August 16, 1859.

Claim—The employment, immediately before the tapping of the furnace, of an auxiliary tuyere pipe or pipes within the hearth of the common blast furnace, when charged with molten iron, at such an inclination as to cause the blast of air to commingle with the particles of iron, and give to the whole mass in the hearth a spiral or rotary motion.

13. BILLIARD TABLE CUSHIONS; H. W. Collender, City of New York; patented December 8, 1857; re-issued August 23, 1859.

Claim—Composing cushions for billiard tables, with a body or back of what is known as the soft compound of vulcanizable india rubber or allied gum, in combination with a facing of india rubber or allied gum, rendered less compressible by fibrous matter, or the equivalent thereof.

14. RAILROAD STATION INDICATORS; C. A. McEvoy, Richmond, Virginia; patented Nov. 20, 1855; re-issued August 23, 1859.

Claim—Presenting a movable sign or symbol to passengers of a railroad car, so that both sides of said sign shall be visible, and utilized as annunciators by passing each sign in turn through an opening of the case, by the revolving of the drum to which the said signs are attached.

15. FAUCETS; James Powell, Cincinnati, Ohio; patented March 22, 1859; re-issued July 5, 1859; re-re-issued August 23, 1859.

Claim—1st, The valve stem, formed with projecting flanches, when confined to a rectilinear path and operated by a cam or eccentric, which engages with it at two opposite points, in the manner set forth. 2d, The arrangement and combination of the slotted head, pivot, socket, and cam, operating in the manner set forth, to prevent lateral motion of the valve stem.

16. LAMPS; Michael A. Dietz, Brooklyn, New York; patented May 3, 1859; re-issued August 30, 1859.

Claim—Combining the deflector with the chimney band by mechanical devices, so as to retain the former in its proper relative position without the use of solder.

17. DEVICE FOR CONVERTING RECIPROCATING INTO INTERMITTENT ROTARY MOTION; Henry Ehrenfeld, City of New York; patented June 21, 1859; re-issued August 30, 1859.

Claim—1st, Arranging the lever and dog, in combination with the grooved wheel, or its equivalent, in such a manner that said lever and dog act on the wheel, without a connexion to the centre or hub of the wheel. 2d, In combination with the lever, dog, and wheel, the arrangement of the groove, or its equivalent, in the hub of the wheel. 3d, Arranging the lever with the dog permanently attached to it in such a manner that the direction of the said lever, when it is in its place, makes an angle of 90°, or nearly so, with a line drawn from the centre of the wheel through the dog.

18. HARROWS; Sidney S. Hogle, Cleveland, Ohio; patented March 7, 1857; re-issued August 30, 1859.

Claim—Causing the points of the teeth of a rotating harrow to descend deeper into the ground on one side of their axes of rotation than they do on the opposite side of the same, for the purpose of enabling the

dragging force which may be exerted upon said harrow, to impart a positive rotary motion thereto without the aid of gearing wheels.

19. ERASER AND PENCIL-SHARPENER; Archibald G. Shaver, Hartford, Connecticut; patented March 8, 1859; re-issued August 30, 1859.

Claim—1st. The curved blade eraser, as specified, forming on one side a convex surface. 2d, In combination therewith, the pencil-sharpener and pointer, as described.

DESIGNS.

1. PARLOR STOVE; Robert Ham, Assignor to Smith, Shelden & Co., Troy, New York; dated August 9, 1859.

2 and 3. CARPET PATTERNS (two cases); E. J. Ney, Assignor to the Lowell Manufacturing Co., Lowell, Mass.; dated August 9, 1859.

4. PARLOR COAL STOVE; Isaac de Zouche, St. Louis, Missouri; dated August 9, 1859.

5. TABLE FORK; N. E. Russell, City of New York; dated August 9, 1859.

6. STOVES; Garrettson Smith and Henry Brown, Assignors to Cox, Whitman & Cox, Philadelphia, Penna.; dated August 16, 1859.

7 and 8. FLOOR OILCLOTH (two cases); James Bogle, West Newton, Massachusetts, Assignor to self and Daniel Bogle, Dover, New Hampshire; dated August 23, 1859.

9. SPOON OR FORK HANDLES; Henry Hebbard, City of New York; dated August 23, 1859.

10. SCALES; Francis M. Strong and Thomas Ross, Brandon, Vermont; dated August 23, 1859.

11. FLOOR OILCLOTHS; Jean Baptiste Virolet, Assignor to John W. Hoyt, City of New York; dated August 30, 1859.

12 to 14. CARPET PATTERN (three cases); Henry G. Thompson, City of New York, Assignor to the Hartford Manufacturing Co.; dated August 30, 1859.

15. THREE-PLY CARPET PATTERN; Henry G. Thompson, City of New York, Assignor to the Hartford Manufacturing Co.; dated August 30, 1859.

SEPTEMBER 6.

1. LAMPS; H. W. Adams, Brooklyn, New York.

Claim—Constructing the upper end of the wick tube with the elevated ends, so as to enclose the ends of the wick and prevent said ends from burning too high, when the central part is sufficiently elevated above the central part of the wick tube to be allowed to burn.

2. APPARATUS FOR MAKING DECOCTIONS; William Adamson, Philadelphia, Pennsylvania; ante-dated April 6, 1859.

Claim—The conical roller arranged within the caldron, when the same is used for the purpose of thoroughly intermixing the ingredients to be extracted during the process of boiling.

3. CUTTING APPARATUS OF HARVESTERS; T. D. Aylesworth, Ilion, New York.

Claim—The cutters and guards, when constructed and operating together without any motion except that of being advanced or drawn over a field.

4. TONGUEING AND GROOVING MACHINE; H. H. Baker, New Market, New Jersey.

Claim—The employment of flanched feed rollers, having a lateral play, and acted upon by suitable springs, in combination with the fixed intermediate rings or flanches, or their equivalents, in the manner specified.

5. RAILROAD EXCAVATORS; E. O. Baxter, Foreston, Illinois.

Claim—The arrangement and combination of the adjustable timbers or arms, plough and excavator, when employed in the manner shown, for the purpose of loosening and removing the earth, and keeping the ditch free from the wash of the slopes on railroads.

6. TURNING; John Brainerd and W. H. Burridge, Cleveland Ohio.

Claim—The use of the described compound for tanning, consisting of a solution of the named mineral salts, in mixture with a solution of tannin, either with or without the addition of aloes.

7. MAKING GAS FROM WOOD; L. R. Breisach, City of New York.

Claim—The process of manufacturing illuminating gas from wood, by distilling the same in two retorts of varying temperatures, one of which retorts is charged with charcoal, varying in amount according to the conditions indicated, the whole process being conducted as set forth.

8. RAILROAD WHEELS; Archibald Cameron, Charleston, South Carolina, and David Matthew, Philadelphia, Pennsylvania.

Claim—The peculiar construction of car wheels, having elastic curved arms, with chilled cast tread and cast hub, forming one combined wheel.

9. MACHINE FOR MAKING WATCH RIMS, &c.; C. W. Clewley, Providence, Rhode Island.

Claim—The combination of the male and female plungers, as described.

10. MACHINE FOR PRINTING THE ADDRESSES ON NEWSPAPERS, &c.; R. W. and Daniel Davis, Yellow Springs, Ohio.

Claim—1st, The arrangement of wooden blocks of suitable size for a single address, with indented letters in their faces, and attached by means of small tacks, or equivalent, to a flexible band or belt in close compact columns, and operated as described. 2d, The use of the triangular stationary bed-piece, over which the belt slides, by means of belt pulley, and regulated and adjusted by means of lever.

11. TREATING METALLIC ORES WITH SPONGY IRON; Jean Justin Albert de Bronac and Augustin Joseph Martial Deherrypon, Paris, France.

Claim—The treatment of metallic sulphurets, or other ores or metallic bodies, with a spongy iron, for purposes set forth, by the combination of the several processes specified in the order stated, viz:—1st, Pulverizing the ore and the spongy iron separately. 2d, Mixing the two powders in definite proportions. 3d, Compressing the mixed powders into the form of cakes or small bricks. 4th, Treating the thus prepared ores in suitable furnaces, as described.

12. MACHINE FOR SAWING STAVES; R. Densmore, South Haven, Michigan.

Claim—1st, Surrounding the stationary drum with a series of saws all hung in one gate, and having the same movement, in combination with the rotating table, in the manner specified. 2d, In combination with the rotary table and drum, the sliding carriages, arranged radially around said drum, and operated automatically to feed the bolts up against the drum. 3d, The rolling spring guides, in combination with the drum for discharging the staves from the machine after they have been sawed.

13. BAGASSE FURNACES; Charles A. Desobry, Plaquemine, Louisiana.

Claim—The combination of the upright air chamber, having a vertical partition wall, and the system of ducts, and the damper or shutter, applied in connexion with the fire chamber and the flue, or its equivalent.

14. PORTABLE EVAPORATING APPARATUS; Hugh T. Douglas, Zanesville, and John Cooper, Mount Vernon, Ohio.

Claim—The combination of the diving flue, the valves, and the damper, arranged in relation to the evaporating pan, and operating in the manner set forth.

15. ROOFING CEMENT; M. D. Dubois, Newburgh, New York.

Claim—A composition formed of the ingredients or substances compounded, in the proportions and in the manner specified.

16. BOOTS; Lewis Duvall, Big Spring, Kentucky.

Claim—The described method of cutting the piece of leather, or other suitable material, and uniting the same with the gore, so that when it is folded in the lines b b' and f f', and if the gore is brought in the proper position, said piece, together with the gore, assumes the required shape of the upper of a boot.

17. MACHINE FOR CUTTING AND FINISHING SHOE-HEELS; Wm. T. Edson, Philadelphia, Pennsylvania.

Claim—The combination of the movable post, the former (on the upper of the shoe), the guide, and the cutter wheel, or an emery or burnishing wheel, with the hand lever, bow guide, springs, and radius bar, for cutting or shaping, smoothing, and burnishing the heels of shoes, either before or after they are fastened to the shoe.

18. AUTOMATIC RAKE FOR REAPING MACHINES; Benjamin G. Fitzhugh and McClintock Young, Jr., Frederick, Maryland.

Claim—The locating of an automatic sweep rake at the rear, left-hand, or outside corner of the platform, when said rake has a rising and falling motion that will admit of its passing over the outside division board or fence, and then drop into or on to the extreme outer end of the platform, and sweep it off the cut grain.

19. FOAM-COLLECTORS FOR STEAM BOILERS; Thomas G. Gardner, Mount Pulaski, Illinois.

Claim—Fitting a boiler with one or more plates, so applied as to present inclined surfaces above the surface of the water, with one or more outlets for steam and foam, at the highest parts of said plate or plates, and as to provide a receptacle for foam above the said plate or plates.

20. APPARATUS FOR MASHING; Edward Hackel, Assignor to Hackel & Co., Cincinnati, Ohio.

Claim—The described combination and arrangement of the central shaft and satellite shafts, the whole being armed with beaters, and rotated simultaneously.

21. FLOOD GATES; E. H. Hancock, Augusta, Georgia.

Claim—The combination of the flood or dam gate, tilting trough, and the draining structure, or its equivalent, as set forth.

22. SEWING MACHINES; Jason W. Hardie, City of New York.

Claim—1st, The method of making the "knot-stitch," by taking the needle-thread at the back of the needle, or at the side opposite to the position of the bobbin, and first doubling it upon itself around the needle and then looping it over the bobbin thread. 2d, The employment of two hooks, acting in opposite directions, when they take the thread at the back of the needle, or at the side opposite to the position of the bobbin, for the purpose of forming either the knot-stitch or the ordinary shuttle-stitch, by simply reversing the motion of the driving shaft. 3d, Making the feed eccentric self-adjusting by means of the loose sleeve, slot, and pin or stop, so that the feeding shall take place during the descent of the needle, whichever way the driving shaft may be turned.

23. CARPET-SWEEPER; Hiram H. Herrick, East Boston, Massachusetts.

Claim—1st, Providing the end of the box with a groove, as from x to x, when the same is used in connexion with the flaring brush on the end of the shaft. 2d, Dividing the box into two parts, and providing each with a partition dividing the bottom of the box in two parts, through which the bruskes protrude, and providing these parts of said bottom with flanches which hold the dirt.

24. AMALGAMATOR; Kelsey Hazen, Brooklyn, New York.

Claim—Compelling the water having the particles of gold in suspension to flow within a certain small distance of the heated mercury, under conditions as set forth. Also, in connexion with the above, the employment of a series of vibrating agitators and scrapers, acting in the space under E, and of an adjustable gate for regulating the facility of egress of the least suspended particles.

25. MOLE-PLOUGHS; Iris Hobson, Stout's Grove, Illinois.

Claim—The combination of a ditching plough beam, having a horizontal joint forward of the mole and coulter, with a rod arranged over the top of said joint, and with a horizontal, adjusting, and stop-plate.

26. DOOR-BOLT; Lewis G. Hoffman, Waterford, New York.

Claim—The combination of a common door-bolt with a barrel containing a wheel, with an arm acting on a slot in the bolt, so that when operated by a key the door may be fastened or unfastened on the outside; the whole being so arranged as not to interfere with the ordinary mode of using the bolt on the inside.

27. MARINE PROPELLERS; Lorenzo Holtslander, Oberlin, Ohio.

Claim—The device described for changing valve seats as applied to water propellers, to reverse the motion of vessels or boats. Also, the combination of the small forward pipes with the reservoir, as described.

28. APPARATUS FOR PRINTING THE ADDRESS ON NEWSPAPERS, &c.; George Hutchison, Alleghany, Penna.

Claim—1st, The inclined hopper with the slides or guides, in combination with the ways and conveyors on the belt, as described. 2d, The use of a metallic belt, furnished with the conveyors, as described. 3d, The arrangement of the pulleys, the belt, press-roller, and inking roller, as described. 4th, The use of the lug on the end of the type frame, when used in connexion with the notch in the conveyor, as described.

29. PARLOR GRATES; Damase Lamoreux, City of New York.

Claim—1st, So constructing the grate that the fuel box and the ash-pit are distinct from, and independent of, the bars, and capable of being removed, while the bars remain undisturbed, thereby enabling me to effect the removal of the ashes and cinders with much less trouble than by the ordinary mode, and thereby keep the apartment free from the dust and dirt which are inseparable from the common method of removal. 2d, The combination of the crank, the rod, and the movable bottom of the fuel box, arranged as described, by which any easy and convenient means of giving a reciprocating, horizontal, circular motion of the grate bottom is secured without the necessity of cutting an opening in front for the passage of an arm, by which to vibrate the grate. 3d, The arrangement, in a parlor grate, of the bottom grate upon which the fuel is supported, in the manner described, by which it is made capable of being vibrated through the back of the fuel box, upon a fixed axis placed entirely back of the space devoted to fuel, the wings of said bottom grate being so extended as to cover or compensate for the necessary vibration which is made into open space back of the fire box.

30. METHOD OF CENTERING IN WATCHMAKER'S LATHES; Pierson Loffel and J. H. Mulholland, Springfield, O.

Claim—1st, A vibrating mandrel, arranged within a socket or hollow spindle, in such manner that its inserted end may fit closely within said socket, and its outer end allowed to vibrate. 2d, In combination with the vibrating mandrel, we claim the rocking collar, spring, key, and nut, arranged to operate as described.

31. SUBMERGED PUMP; Hosea Lindsey, Ashville, North Carolina.

Claim—The arrangement of the short reciprocating piston rod, open pistons, sliding ring valves, cylinder, having a conducting pipe, with the chain and brake, in the manner set forth.

32. STEAM PANS FOR CLARIFYING SUGAR; George M. Longacre, New Orleans, Louisiana.

Claim—In combination with the pans, the relief valve, and the check valve, arranged as set forth.

33. LAMPS; Justus R. Loomis, Winsted, Connecticut.

Claim—The arrangement of the cylindrical corrugated skirting, perforated tubes, adjustable radiating wires, in the manner described.

34. STOVES; Edward M. Manigle, Philadelphia, Pennsylvania.

Claim—The arrangement of the series of distinct or uncommunicating hollow open air chambers, or their equivalents, in combination with the cross-piece of the top plate of a cooking stove, in the manner described, and this I claim whether the said cross-piece be either movable or stationary in the said top plate.

35. MACHINE FOR WIRING THE JOINTS OF CLOTHES-PINS; Alvin C. Mason, Springfield, Vermont.

Claim—1st, The intermittently rotating pliers, in connexion with a clamping device formed of the jaws, recess, and lever, or their equivalents, and shears, arranged to operate as set forth. 2d, In combination with the pliers and shears, and clamping device, the sliding forks, arranged for joint operation. 3d, The particular manner of opening and closing the pliers, and operating the arbors, to wit: by means of the sliding cones in connexion with the springs and permanent bosses on the arbors, whereby the jaws of the pliers are opened and closed, and the arbors shifted by a very simple mechanism.

36. BRAKES FOR RAILROAD CARS; Thomas J. Mead, Port Byron, New York.

Claim—The combined use of the U-shaped yoke, the brake bar, and the short brake blocks, for the purpose of adapting the brake to a simple lever that acts directly upon it.

37. MACHINE FOR BENDING WAGON-TIRE; Wm. and Isaac H. Mosher, Greene, New York.

Claim—The clutch or clasp to hold the end of the bar, in combination with the former being made three-fourths of the circle, and the arrangement of the lever, for operating as specified.

38. TRUNKS; Jacob Parker, St. Louis, Missouri.

Claim—1st, Forming the lid of the trunk in the shape of a semi-cylinder, as specified. 2d, The impervious box or sponge-carrier, arranged in the tray as described. 3d, The peculiar formation of the division boards, in such manner that they will come down on to the rim of a gentleman's hat, placed in the middle hat box.

39. BITS FOR CUTTING WASHERS; Henry Pennie, Buffalo, New York.

Claim—1st, The arrangement of the cutters upon the ends of the sliding bars, and at right angles thereto; the said sliding bars passing through a mortise in the shank and lying parallel with each other, and one above the other, so that the cutters will work upon the same side of the centre-point. 2d, The recess made in the lower end of the shank, so as to allow the inner cutter to slide close up to the point, and thereby adapt the instrument to cutting very small washers.

40. FAUCET; James Powell, Cincinnati, Ohio.

Claim—The elastic annular valve seat and sliding collar, in the described combination with an adjustable plug valve of hard metal.

41. CONSTRUCTION OF SHEET-METAL COFFINS; Isaac C. Shuler, Amsterdam, New York.

Claim—1st, The construction of a sheet-metal coffin in two sections, stiffened with frames or straps, and, in dividing the coffin into two sections, I do not confine myself to any particular locality on the sides for making the joints, but claim forming the joint on the side of the wall at any convenient point between the flanch and the rim, and concealing the same with an adjustable moulding. 2d, The frames for stiffening the coffin, and also the scrolled rim or joint.

42. STOVES; David G. Stafford, Syracuse, New York.

Claim—The combination of a self-regulating valve applied to the smoke-pipe of coal stoves, and operating as set forth, with an air-flue surrounding the fire-box, as described.

43. GRATES; Joseph Tiben, St. Louis, Missouri.

Claim—Arranging the adjustable furnace back in the furnace place, and constructing the same as set forth.

44. JOINER'S CLAMP; William S. Todd, Mechanicsville, Iowa.

Claim—The combination of the adjustable lever with the frame and sliding block, arranged in the manner set forth.

45. CONSTRUCTION OF CANE JUICE BOXES; Louis Tregre, Parish of St. John the Baptist, Louisiana.

Claim—The method of separating the pure from the impure parts of the juice, when the latter has settled to the bottom of the box, so that the pure parts can be drawn off without disturbing the impure, by dividing

the one from the other by means of a movable partition valve, or its equivalent, arranged within the box, as described.

46. Hot Air Register; E. A. Tuttle, Brooklyn, New York.

Claim—The arrangement and combination with the leaves of the roller, having its axis movable and traveling on a shelf, with or without springs, as described.

47. Mode of Operating the Fingers of Printing Presses; Stephen D. Tucker, Assignor to R. M., R., and P. S. Hoe, City of New York.

Claim—Operating the finger-shaft by means of a grooved disc attached thereto, and the roller attached to a plate or proper support, so as to be respectively within and without the path of rotation of the finger-shaft.

48. Printing Presses; Lemuel T. Wells, Cincinnati, Ohio.

Claim—In the described combination with stationary buttments on the ways, I claim the attachment to the bed of a closed cylinder, its piston having a stroke relatively less than that of the bed, and acting to simultaneously condense and rarify the air at alternately opposite ends of the cylinder, as set forth.

49. Opening Valves to Extinguish Fire; S. H. Wilder, Grinnell, Iowa.

Claim—The arrangement of a reservoir, or other means of producing pressure, combined with a system of tubes, cross tubes, and valve shafts, with valves and stop-cocks, arranged as described, when used as a means of operating upon a cylinder and piston, or a water wheel, for the purpose of starting and afterwards stopping the wheel or engine without the intervention of any person than the one who discovers the fire. Also, the use of gear wheels, rack bar, and blank wheel, or their equivalents, arranged to move the gate of a water wheel out and in alternately by a repetition of the same motion.

50. Apparatus for Watering and Sweeping Railways; Wm. C. Allison, Assignor to self and John Murphy, Philadelphia, Pennsylvania.

Claim—1st, The horizontal perforated pipe and the swing pipes, in combination with a truck having wheels adapted to the rails of a passenger railway, the said truck carrying a tank, and the said swing pipes being arranged and operatad by the devices described, or their equivalents. 2d, The combination of the adjustable revolving brushes with the truck, arranged in respect to the rails, as specified. 3d, In combination with the brushes, any convenient number of projections, revolving simultaneously with the said brushes, and so arranged in respect to the rails as to clean the grooves or corners of the treads from all obstructions.

51. Feed-water Apparatus for Steam Boilers; Wm. Barnes, Assignor to Philo B. Stewart, Troy, N. York.

Claim—1st, In combination with a steam boiler and a close chamber, placed higher than, or at the same height as, the steam boiler, and having communication therewith by a steam passage and a water passage, each provided with a stop-cock or valve, a close receiver located lower than the boiler, and having a steam passage from the boiler and a water passage into the chamber for use in raising water from a place lower than, and introducing it into, the boiler while the boiler is charged with steam. 2d, In combination with the matter above claimed, making the receiver in two parts, with the steam pipe from the boiler and the cold water supply pipe, both entering one part, and the hot water supply pipe entering, and a water pipe to the chamber, leaving the other part, and with the two parts of the receiver connected together by a passage, as set forth.

52. Mode of Applying Power to Machinery; Delectus Durfey, Fort Seneca, Assignor to self, L. A. Lyon, and H. P. Tyler, Clarksfield, Ohio.

Claim—The combination of the treadle levers, arms, and springs, with the grooved wheel and spring braces, operating as described.

53. Compound Illuminating Fluid; N. A. Dyer, Medford, and J. F. Augustus, Boston, Mass., Assignors to Joseph C. Tucker, Brookline, New Hampshire.

Claim—The combination of ingredients, for the purpose set forth, and essentially in the proportions described.

54. Printing Presses for Addressing Newspapers, &c.; George Henderson, Assignor to self and George Hutchison, Alleghany, Pennsylvania.

Claim—1st, The combination and arrangement of the guide table and pulley, the press-wheel, the conveying pulley, and inking rollers, with type frame and the open hopper, arranged in the manner specified. 2d, The use of the open hopper, constructed as described. 3d, The use of the pins, or their equivalent, on the type frame, for the purpose of carrying forward the papers.

55. Watches; Charles E. Jacot, Assignor to Saltzman, Jacot & Co., City of New York.

Claim—1st, Constructing the bridge or plate with the curve and index, for the purposes specified. 2d, Constructing the bridge plate separately from, but screwed to, the three-quarter plate, for giving access to the centre, second, and third wheels, without removing said three-quarter plate. 3d, Attaching the three-quarter plate to the dial plate, by riveting the columns to the plate and inserting the screws at the dial plate, for the purposes set forth. 4th, Constructing the click spring, as specified, for preventing the ratchet teeth being broken.

56. Stoves; John Martino, Assignor to D. Stuart and Richard Peterson, Philadelphia, Pennsylvania.

Claim—The division plate, L, with its damper, the plate, k, with its openings, and the casing with its wings, arranged in respect to each other and to the outer casing and fire-pot, as set forth.

57. Forcing Pump; Robert Poole, Assignor to self and German H. Hunt, Baltimore, Maryland.

Claim—Enlarging the areas of the inlet and exit openings, where they connect with the pump cylinders, by means of the swells, in the manner set forth.

58. Pistons of Pumps; Robert Poole, Assignor to self and German H. Hunt, Baltimore, Maryland.

Claim—A valve made of flexible material hung loosely upon the piston rod, and having for its bearings the round edged wings of the nut by which it is fastened to the piston, in the manner described. Also, in combination with a flexible valve and winged screw-nut, a piston constructed of ribs, which presents sharp edges to the water while they are flat at the end, which constitutes the seat of the flexible valve, in the manner described.

59. Automatic Fan; John B. Powell, Assignor to self and G. B. Frick, Philadelphia, Pennsylvania.

Claim—The spindle, with any convenient number of cog-wheels of different sizes, in combination with a similar number of cog-wheels, also of different sizes, on the crank spindle, when the said spindle and its wheels are rendered adjustable, and are applied to, and combined with, the work of the automatic fan.

60. TIN-FOLDING MACHINES; Charles H. Raymond, Assignor to the Pecksmith Manufacturing Co., Southington, Connecticut.

Claim—The arrangement of the clamp with bed-piece and folder, when combined with revolving gauge, so that the width of the crimp or fold may be first gauged, and then that portion of the tin contiguous to the part intended to be folded be first firmly clamped and held fast, and then the fold or crimp formed thereon, in the manner described, all by one simple movement of folder, and parts in connexion, and without marring the tin.

61. HARVESTING MACHINES; G. W. Richardson and Robert Glover, Assignors to selves, J. B. Williams, and W. A. Horrell, Grayville, Illinois.

Claim—The cams, cast in sections of one or more, and secured to the driving wheel by means of a bolt or screw and flanch, in the manner described.

62. MACHINES FOR BREAKING STONES FOR TURNPIKE ROADS, &c.; Ives Scoville, Assignor to self and W. H. Scoville, Chicago, Illinois.

Claim—The arrangement of the funnel-shaped hopper, constructed as described, with the two vertical cylinders, as described, for the purpose of breaking stones for ballasting railroads and Macadamizing streets, turnpikes, &c.

63. GAS BURNERS; Daniel H. Solliday, Philadelphia, Pennsylvania, Assignor to Edward H. Ashcroft, Boston, Massachusetts.

Claim—The application of the conical or chambered burner to the main burner, in manner set forth.

64. MACHINE FOR MAKING PAPER-BOXES; Silas B. Terry, Assignor to Silas B. Terry, Jr., Terrysville, Conn.

Claim—1st, The pressure roller, in connexion with the rotating clamp formed of the head and disc, arranged as set forth. 2d, In combination with the pressure roller, head, and disc, the ring or band provided with the pins or stripes, the socket provided with the screws or pins, and the guide plate, arranged as described. 3d, The arrangement of the pressure lever and sliding mandrels, for the purpose specified. 4th. The employment or use of the folding device formed of the plate provided with the ledge, and the pivoted bar, when said folding device is used in connexion with the pressure roller, rotating head, and disc.

65. SKELETON SKIRTS; Joseph Wesley, Assignor to Joseph B. Wesley, Providence, Rhode Island.

Claim—A skirt having its hoops supported by tapes or straps, which are rendered adhesive by the application of caoutchouc or gutta percha, in the manner described.

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66. SADDLE-TREES; Henry Adams, City of New York.

Claim—A tree for side or ladies' saddles, constructed by connecting the bars by a bridge at the point specified, and with an open space between the front ends of the bars, at their junction with the horns.

67. RAILS FOR RAILROADS; George S. Avery, Cross River, New York.

Claim—An improvement in railroad iron bars or rails by an offset or bend, made in one end of the rails, and the lapping on of the other end of the rails, and inserting a key between them at the lap, and riveting or bolting them together.

68. DITCHING PLOUGHS; O. S. Bartlett, Romulus, New York.

Claim—The combination of the arms, brace, rods, and blocks, as set forth. Also, the mode of attaching and adjusting the shares by means of the packing blocks, in combination with the bolts and arms, in the manner specified.

69. STRAW-CUTTERS; A. F. Blunk, Indianapolis, Indiana.

Claim—A straw-cutter, constructed with angular knives, arms, wheel, feed rollers, slides, springs, band, pulleys, and endless belt, arranged to operate as described.

70. WINDOW-SASH FASTENERS; E. K. Breckenridge, West Meriden, Connecticut.

Claim—The employment or use of two cams, placed on a common arbor, with a spring applied to them and a lever fitted within a frame, and arranged to operate as set forth.

71. SEED PLANTERS; Z. B. Brown and M. C. Godard, Granby, Connecticut.

Claim—The arrangement and combination of the carrier and stamping wheels, cams and marker device, upon the wheel, the reciprocal levers, seed slides or valves, hoppers, drill formers, and covering shares, in the manner described.

72. SEWING MACHINES; J. S. Buell, Buffalo, New York.

Claim—1st, In combination with the stationary corrugated surface, the corrugated foot-piece, constructed as set forth. 2d, In combination with the needle or its thread, the conical spool and guide, for causing the slack in the thread to form the loop, and holding said loop from turning until seized by the looper.

73. SEED DRILLS; Stephen Burrows, Lima, Wisconsin.

Claim—The employment of a grooved ring fitted on the axle or shaft of a seed drill, in combination with the peculiarly constructed tube, leading from the hopper into the groove of the ring.

74. CHURN; William Campbell, Waterloo, Pennsylvania.

Claim—The perforated and hinged floats, as an improvement in the construction of dasher-heads for churns.

75. EXTRACTS OF FRUIT; Rosanna Carpenter, Medford, Massachusetts.

Claim—The described extract of fruit, prepared in the manner specified.

76. HAND-MILLS FOR GRINDING APPLES, &c.; R. P. Clark, Johnstown, New York.

Claim—The described improved hand-mill for household use, in reducing apples, potatoes, and other fruits and roots to pomice—the teeth of the combined cylinder and adjustable yielding concave being formed and arranged in the particular manner set forth.

77. FASTENING FOR SHIRT STUDS; Barnes Clayton, Philadelphia, Pennsylvania.

Claim—The hollow sliding case and spring, in combination with the tie or post and the bar, arranged to operate together in the manner set forth.

78. WIRE FENCES; P. S. Clinger, Conestoga Centre, Pennsylvania.

Claim—The combination of the pin with the ratchet in connexion with the mortised posts and the hooked wires, arranged as described.

79. COTTON SEED PLANTERS; T. T. and H. W. S. Collier, Lavernia Texas.

Claim—The arrangement and combination of the distributor and the stirrer, constructed as described, to operate in combination with the packing wheel.

80. SIGHTS FOR FIRE ARMS; Henry W. Colvin, Pendleton County, Kentucky.

Claim—The semi-circular form of the fore-sight with its range-piece or bead and shades, and triangular form of the hind-sight with its needle or range and shades, substantially as described, and for the purpose set forth.

81. ROTARY HARROWS; George Cook, Paris, Illinois.

Claim—The arrangement of the teeth, placed eccentrically on triangular frames which rotate on oblique pivots, as specified.

82. COFFEE-POTS; Solomon Crowell, Jr., Palmyra, New York.

Claim—The combination of the perforated diffusing chamber, having a tight conical bottom, with the concentric perforated digester, whereby the coffee is exposed in a thin layer of nearly uniform thickness, to the water percolating nearly uniformly through all parts.

83. BRAKES FOR RAILROAD CARS; Henry Davis, Baltimore, Maryland.

Claim—Increasing the frictional action of the car brakes upon the peripheries of car wheels, by the introduction of sand, or its equivalent, between the frictional surfaces, at the time that the brakes are brought in contact with the car wheels.

84. PIANO-FORTE ACTIONS; David Decker, City of New York.

Claim—1st, Attaching the relieving jacks and regulating screw directly to the key, or to some part carried by the key, so that the repeating lever shall govern the action of the relieving jack, by or through the said regulating screw, whether constructed in this precise manner or in an equivalent. 2d, The groove, in combination with the tongue, pin, or equivalent, for the purpose of keeping the lifting-jack in its proper position in relation to the repeating lever, and for preventing any binding or sticking of said repeating lever and lifting-jack. 3d, So arranging the adjustable piece and repeating lever, both or either of them, so that their regulating screws, both or either of them, shall be at or near the end next toward the front of the key, in front of the hammer rail, for the purpose of being thus conveniently placed for regulating.

85. PRISON LOCK; Sylvanus A. Denio, Boston, Massachusetts.

Claim—The lock or part, b, with its parts, c e i and k, arranged with each other, as described, to move, hold, and lock the bolt, k, in door, l, when combined, positioned, and secured with lock, h, which in turn locks the shaft, all by turning a single knob—all the parts being constructed and operated in the peculiar manner described.

86. HEELS FOR BOOTS AND SHOES; Simeon Dodge, Jr., and Benjamin Potter, Jr., Marblehead, Massachusetts.

Claim—A heel having a concave seat and a flat tread, with its rises united by cement.

87. SWITCH-STAND FOR RAILROADS; Thomas Dougherty, Macon, Georgia.

Claim—The combination of eccentric with the pin, c, through lever to bar, for the purpose of locking and unlocking the main pin, A, to and from notches, M M M.

88. FAUCET; Eugene Duchamp, St. Martinsville, Louisiana.

Claim—The arrangement and combination of the oblique slot, handle, stem, and tube, so that on turning the handle, the stem will rise and fall with a spiral or screw movement, thus insuring ease of operation and tightness of packing.

89. FILTER; Eugene Duchamp, St. Martinsville, Louisiana.

Claim—The employment of fine spun glass, arranged in the manner set forth, in combination with the reservoir, floating valve chamber, and pure water chamber.

90. APPARATUS FOR HEATING WATER; Eugene Duchamp, St. Martinsville, Louisiana.

Claim—The combination and arrangement with the false bottom and tank, of the perforated casing, fire chamber, draft-pipe, and smoke-pipe, as described.

[This invention consists in placing within a cylinder or outer casing, perforated at the top and bottom, a smaller cylinder, which latter serves as a fire chamber; these are placed in the centre of a tub having a false bottom, so that when the water, clothes, and soap are put around the boiler in the tub, and a fire made in the inner chamber, a constant rotary current of the water in the tub will be obtained, and the dirt carried to the bottom of the tub.]

91. MOP-HEAD; John Fasig, West Salem, Ohio.

Claim—The construction of a mop-head, consisting of the piece with the slot and hole, in combination with the rod and notches, screw and nut, arranged as set forth.

92. HARNESS; Jacob Fassnacht, New Milltown, Pennsylvania.

Claim—The device of combining the hip-strap and breech band in one continuous piece for each half, united at B B to form the breeching.

93. HYDRAULIC OIL PRESSES; William R. Fee, Cincinnati, Ohio.

Claim—1st, The peculiar construction of the dies and followers, having the grooves and conduits, and also the oil passages, to facilitate the expression of oil. 2d, The solid truss, when made a part of the press, and worked by means of the rack and pinion. 3d, The hinged hoop for charging the press.

94. CULTIVATORS; J. H. Frampton, Hopewell, Ohio.

Claim—The adjustable share standards attached to the parallel adjustable bars, D D, which are secured to the beam by the bars, E E', arranged as set forth.

95. CHURN DASH; Daniel K. France, Congress, Ohio.

Claim—The metallic strips attached to the convex surface of the slats, by slots and screws, and operating in the manner set forth.

96. CHURN; C. L. Gilpatrick, Saco, Maine.

Claim—The combination of the crank-shafts and staffs with the top, when said top is provided with boxes, in which play slides through which the staffs pass.

MECHANICS, PHYSICS, AND CHEMISTRY.

*On Embroidery by Machinery.** By GEORGE WALLIS.

(Continued from page 277.)

Discussion.—Mr. FREDERICK LAWRENCE inquired whether different colored silks or threads were worked in the machine at the same time.

Mr. WALLIS replied that in producing chintz effects, as many colors as might be necessary could be used in different needles, but in getting the shaded effects, as shown in some of the examples, the "trick," for such it really was, of shading the silk in dyeing from light to dark had to be adopted; and thus a certain variety of effect was produced, although this was not always of a very artistic character.

Mr. WILLIAM HAWES said, looking at this paper, not with the eye of a manufacturer, because he had no knowledge to enable him to form an opinion upon the subject, but as being very interesting in a social point of view, he would offer a few remarks upon one or two matters connected with the subject. The first point which struck him, was that this invention afforded employment to women. It was that peculiar kind of occupation which, whilst stimulating the taste, was capable of becoming a domestic manufacture, and was, therefore, of the greatest benefit to that class which stood most in need of employment. This machine appeared to effect the important end of the economical working of a costly material; for they understood from Mr. Wallis that they could measure, almost to the fractional part of an ounce, the quantity of silk necessary to produce a certain amount of embroidery; and, when that fact was known, all temptation to fraud on the part of the work-people ceased; whereas, in times past, when the silk machines were employed in the houses of the workers, they became a source of constant collision between the employers and the employed, in accounting for the material entrusted to them for the purposes of manufacture. If this machine was capable of doing certain descriptions of embroidery, as well as, or better than, hand labor, and employed persons for whom employment was required, and, at the same time, allowed the manufacturer to entrust a valuable commodity in the hands of the work-people, without fear of fraud—on all those grounds it must be regarded as a valuable addition to our mechanical resources. They had been told that the machine was not, in all cases, capable of producing such perfect results as were obtained by hand labor; but they were likewise told that for some descriptions of goods it produced a better and cheaper article than hand labor could supply. These were points which he thought were especially deserving the attention of the Society; and he considered that they were very much indebted to Mr. Wallis for the clear manner in which he had put before them the benefits which manufacturers and the public might derive from machines of this kind.

Mr. DAVID CHADWICK said, although not connected with this branch

* From the Jour. of the Society of Arts, No. 333.

of manufacture, he wished to call the attention of Mr. Wallis to an omission in his paper. He did not hear that any mention was made of a gentleman in Lancashire who had devoted a great deal of attention to embroidery—Mr. Gilbert French, of Bolton. He had visited the works of that gentleman, and had noticed the large number of females who were employed upon this beautiful work, and he had seen specimens of embroidery which, to his eye, were more beautiful and elaborate than those exhibited that evening. Although, as a Manchester man, he felt proud of the honorable mention that had been made of Mr. Houldsworth, yet he thought it would have been well if Mr. Wallis had brought forward some specimens of hand labor in this branch of art, produced by first-class workers of the present day, so as to compare them with the best productions of machine embroidery. As one of the public he thought Mr. Wallis's paper was somewhat defective in some portion of its statistics. He had given them minute particulars of the process by which the work was effected, but he had not given any comparison of the cost of producing these beautiful articles by machinery as compared with that of hand labor. To the public generally it was a matter of little importance by what means a particular article was produced; they were only interested in the economy of the production. Those who purchased these fabrics were astonished at the price at which beautiful table covers could now be obtained, as compared with the cost of similar articles ten or fifteen years ago. He should be glad to hear from Mr. Wallis, if he was able to furnish it, a comparative statement of the cost of producing these articles by hand labor and by machinery. During his (Mr. Chadwick's) visit to Mr. French's establishment, he was informed that that gentleman supplied hand-worked patterns of embroidery of the most costly description, not only to every part of England, but almost to every part of Europe, and that he found, notwithstanding the increasing production of machinery, the demand for hand embroidery work had been constantly advancing.

Mr. WALLIS said he feared that Mr. Hawes had misunderstood his remarks as to the increase of domestic employment occasioned by the stimulated production of embroidery in 1847-8. The machines could never be brought into use in the houses of the workers like the sewing machines, as they were of too cumbrous and costly a character. All that was meant in this direction was to call attention to the fact that the demand for hand labor was increased by the action of the machines in cheapening production and thus stimulating demand.

Mr. HAWES said he had merely quoted from the paper itself, which stated, "so far from interfering with the hand labor, it is a fact that, in 1849, there were in London alone some 2000 persons obtaining their living from embroidery who had never done so before, and in Scotland and the north of Ireland some thousands of females were employed in this industry, not in large factories, but in their own houses."

Mr. WALLIS continued—With respect to Mr. D. Chadwick's remarks, it happened that Mr. Chadwick was a statist, and he (Mr. Wal-

lis) an artist; both studied figures, but they were of a different kind. He had great respect for figures in arithmetic, and no doubt it would have added to any value there might be in his paper if some comparative statement could have been made as to the cost of production in certain classes of work by machine and hand embroidery. It happened, however, that one or two articles would be no test whatever for any other article, as each would have to be judged of by the quantity of work in each under the precise conditions of its production, for, as shown in the paper, economy in machine embroidery depended upon the greatest use of the needles, and adaptation of the pattern to length of thread, &c. With respect to the excellent productions of Mr. Gilbert French, of Bolton, he (Mr. Wallis) thought he had carefully guarded himself from misapprehension when he stated that his subject was commercial and not artistic embroidery; besides, he had illustrated by a reference to certain examples, the fact that the machine could not produce large and massive patterns of an exceptional character with the same economy as small repeats; nor did he believe that, on the whole, the larger works would possess the artistic qualities of good hand embroidery. His object had not been comparison, but a simple statement of what the embroidery machines could do.

Mr. G. F. Wilson, F. R. S., said there was one point of great interest mentioned in the paper, which had a particular bearing upon the matter which they were all so anxiously discussing—namely, the great Exhibition of 1851. It had been shown that this machine had been first brought out at the national exposition of products at Paris, which was another fact added to the many that had already appeared in the *Journal* of the Society in connexion with exhibitions.

The Chairman remarked that it would be clear to all present that when Mr. Wallis undertook to read this paper, he entered upon a difficulty. When he (the Chairman) first heard the announcement of this paper, he could not conceive how Mr. Wallis could make them comprehend the subject without a machine to illustrate it. But they must all admit that he had explained it well, and that they now really understood how embroidery by machine was accomplished. With regard to the statistics of economy by this process, which had been asked for by Mr. Chadwick, they would understand that in a certain class of goods the economy was twenty times as great as in others. Some of these machines would carry 100 of these needles in one length, and work two frames at the same time—working 200 needles in a simultaneous operation. It appeared that a machine of this description required the attendance of one person to work the pantagraph point, four girls to move the frame, and three others to thread the needles. Thus, they had 200 needles at work with the labor of 8 persons, which made a proportion of 25 needles to 1. In some cases there would be no economy at all in the use of the machines; but it was in such articles as table covers and embroidered cloths that the economy of the machines was most apparent. In the embroidery of one of the table covers exhibited, they would probably have two rows of 96 needles each at work, and from the length of the frame they could work two covers at once;

and, at the same time, the manufacturer had the satisfaction of knowing that he could not be robbed of his silk, as they could calculate almost to a drachm what quantity of silk was consumed in working a particular pattern. Mr. Wallis did not go quite far enough back in his history of the use of these machines. He (the Chairman) remembered that about the year 1834, Mr. Schwabe undertook a very large contract from a city house for embroidered merino dresses; he believed that was the occasion of the first introduction of machine embroidery for ladies' dresses. He might observe that since sewing machines were introduced they had heard very little about distressed needlewomen, and it was evident that the introduction of the embroidery machine had greatly increased the demand for that branch of labor. Machine labor and hand labor acted and re-acted upon each other, the one creating a demand for the other. He had now to propose that which he was sure would be passed with acclamation, namely, a vote of thanks to Mr. Wallis for his interesting paper.

The vote of thanks having been passed,

Mr. Wallis briefly acknowledged the compliment.

The paper was illustrated by a large number of fine specimens of machine embroidery, lent by Messrs. Houldsworth & Co., of Manchester, as well as by several working diagrams prepared by Mr. Wallis. Messrs. Wilson and Newton exhibited their Boudoir Sewing Machine.

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*Heat-conducting Power of Alloys.**†

(Continued from page 190.)

In the *Mining Journal* of last week we gave so much of the paper by Messrs. Crace-Calvert and Richard Johnson as related to the conducting power of pure metals, and now purpose giving a sketch of the remaining portion of the paper, to which, from its elaborate character, it is impossible to do full justice. With respect to the influence of small amounts of impurities on the conducting powers of metals, they thought it would be useful to ascertain the influence which 1 per cent. of a metal exercises when added to another, and these are the curious results obtained with gold and silver:—The conducting power of pure gold was found to be 981, taking silver at 1000, whilst gold with 1 per cent. of silver was only 840. Therefore the addition of 1 per cent. of silver, the best conductor, to gold diminishes its conducting power nearly 20 per cent.

They also examined the influence of carbon on the conductibility of iron, and they found the difference to be about 18 per cent.; thus malleable iron is 436; steel, 397; and cast iron, 359. The influence of a non-metallic substance on a metal is confirmed by the results obtained. Cast copper is represented by 811; with 1 per cent. of arsenic, 570; with 0·5 per cent. of arsenic, 669; and with 0·25 per

*From the London Mining Journal, No. 1232.

†For the information of our non-chemical readers—Sn means tin; Pb, lead; Sb, antimony; Bi, bismuth; Cu, copper; Zn, zinc. Sn 3Cu means 1 part of tin combined with 3 parts of copper, and so on.

cent. of arsenic, 771. The conduction of heat by alloys may be considered under three general heads—1. Alloys which conduct heat in ratio with the relative equivalents of the metals composing them.—2. Alloys in which there is an excess of equivalents of the worse conducting metal over the number of equivalents of the better conductor, and which present the curious and unexpected rule that they conduct heat as if they did not contain a particle of the better conductor.—3. Alloys composed of the same metals as the last class, but in which the number of equivalents of the better conductor is greater than the number of equivalents of the worse conductor; in this case each alloy has its own arbitrary conducting power; the conductibility of such an alloy gradually increases, and tends towards that of the better conductor of the two metals composing the alloy.

The first class are those which conduct heat in the ratio of the conductibility of the metals composing them. This class is represented by the alloys of tin and lead and tin and zinc:—

TIN AND LEAD.

Formula of the alloys and percentage.				Silver=1000. Found.	Calc.
5 Sn=73·97	+	1 Pb=26·03	..	385	386
4 Sn 69.44		1 Pb 30·56	..	381	381
3 Sn 63·01		1 Pb 36·99	..	375	372
2 Sn 53·18		1 Pb 46·82	..	350	350
1 Sn 36·22		1 Pb 63·78	..	230	236
1 Sn 22·11		2 Pb 77·89	..	313	317
1 Sn 15·91		3 Pb 84·09	..	311	309
1 Sn 12·44		4 Pb 87·56	..	301	304
1 Sn 10·20		5 Pb 89·80	..	299	301

TIN AND ZINC.

Formula of the alloys and percentage.				Silver=1000. Found.	Calc.
5 Zn=73·43	+	1 Sn=26 57	..	541	572
4 Zn 68·86		1 Sn 31·14	..	574	564
3 Zn 62·43		1 Sn 37·57	..	530	551
2 Zn 53·11		1 Sn 46·89	..	522	532
1 Zn 35·6		1 Sn 64·39	..	501	495
1 Zn 21·65		2 Sn 78·35	..	475	467
1 Zn 15·55		3 Sn 84·45	..	458	451
1 Zn 12·14		4 Sn 87·86	..	457	447
1 Zn 9·95		5 Sn 90·05	..	456	442

The above two series of alloys were the only ones which conducted heat as above stated, and from experiments they believe that the metals composing these alloys are simply mixed, and not combined together.

The study of the class of alloys containing an excess of the worse conducting metal being most interesting, they made many experiments to discover why the presence of one metal completely annihilates the conducting power of the other, especially when the latter is the better conductor of the two. The following statements afford an illustration:—

LEAD AND ANTIMONY.

Formula of the alloys and percentage.				Silver=1000. Found.	Calc.
1 Pb=61·61	+	1 Sb=38·39	..	190	251
1 Pb 47·60		2 Sb 52·40	..	185	237
1 Pb 34·86		3 Sb 65·14	..	184	225
1 Pb 28.63		4 Sb 71·37	..	179	219
1 Pb 24·30		5 Sb 75·70	..	179	215

ANTIMONY AND BISMUTH.

Formula of the alloys and percentage.				Silver=1000. Found.	Calc.
1 Sb=37·74	+	1 Bi=62·26	..	62	110
1 Sb 23·26		2 Bi 76·74	..	59	91
1 Sb 16·81		3 Bi 83·19	..	59	83
1 Sb 13·17		4 Bi 86·83	..	47	77
1 Sb 10·82		5 Bi 89·18	..	48	75

It will be perceived that the alloys of lead and antimony conduct heat almost as if the square bars examined were composed of pure antimony, for if lead had influenced the passage of heat through the bars, the conducting power of the alloys would have been much higher.

The most important series of this class of alloys are those composed of tin and copper. The results obtained were:—

COPPER AND TIN. Formula of the alloys and percentage.				Silver = 1000. Found.	Calc.
Cu = 34·98 +		Sn = 65·02	..	415	... 558
Cu	21·21	2 Sn	78·79 ..	431	... 504
Cu	15·21	3 Sn	84 79 ..	423	... 481
Cu	11·86	4 Sn	88·14 ..	406	... 468

COPPER AND TIN. Formula of the alloys and percentage.				Silver = 1000. Found.	Calc.
Cu = 9·73 + 5		Sn = 90·27	..	396	... 459
Sn	38 21	3 Cu	61·79 ..	494	... 670
Sn	31·73	4 Cu	68·27 ..	155	... 686
Sn	27·10	5 Cu	72·90 ..	207	... 705

The results obtained with one part tin and four parts copper were so extraordinary that the bar first prepared was re-melted and cast, from a fear that there might be in the mass some vacant space, or hole, impeding conduction; but as it yielded the same results when submitted to experiment, they decided to make a new bar, weighing most carefully the metals to be used, and also the bar when cast; the loss being only 0·5 per cent., they were satisfied that the bar was sound, and still it gave the same figures as the bar first experimented with, and, therefore, they concluded that an alloy of tin and copper containing 68 per cent. of the latter metal, has a conducting power five times less than it should have according to theory. From the above results, it is highly probable that these alloys of tin and copper, and especially the three last, are definite chemical compounds; for if they were mixtures they would conduct heat in ratio to the equivalents of the metals composing them, and would not each have a peculiar and different conductibility. These views were substantiated by experiments which they have made with square bars, composed of sectional parts of copper and tin. These bars were made by Mr. Dancer, a very skilful optician, and the parts were soldered together with tin solder, in so thin a layer that it did not occupy a space of 0·25 millimetres in the five junctions. The first three bars they employed were of the usual dimensions, and composed of cubes of copper and tin, each 1 cub. cent., arranged in the following order:—Bar No. 1—2 cubes tin, 2 cubes copper, 2 cubes tin; bar No. 2—2 cubes copper, 2 cubes tin, 2 cubes copper; bar No. 3—cubes of tin and copper alternately. These bars conducted heat nearly as the theoretical results indicate, No. 1 giving 541 (silver = 1000), whilst 568 was the theoretical calculation; No. 2 giving 575, 696 being the theoretical number, and No. 3 giving 570 instead of 634. The slight difference being probably due to the tin solder existing between each cube, and to the cubes not being perfect in all their dimensions. They were, however, not prepared for the curious results obtained with a bar composed of two longitudinal bars of tin, soldered to two of copper, and placed in juxtaposition; for although it contained in 100 parts the same weight of tin and copper as the last bar, it conducted heat at quite a different rate; in fact, its conductibility was the same as if the bar had been composed entirely of pure copper, and did not contain half its bulk of tin—this bar (No. 4) gave 829, whilst theoretically it should only have given 634. These interesting results were confirmed by having similar bars made of copper and zinc and copper and lead; the former gave 842,

whilst 731 was calculated; the latter 723, whilst 515 was calculated. They next had a bar (No. 7) made in which there was the same relative weight of tin and copper, but in which the surface of the two metals in contact was only one-half of that in the bar No. 4, and although the results leave some doubt whether the surfaces have an action, the figures are sufficiently different to deserve serious consideration. Although bars 4 and 7 theoretically gave the same results, it was found by experiment that whilst the former gave 829, the latter gave but 757. From their researches they conclude that tin, zinc, and lead exercise a marked action on the conductibility of the copper.

With respect to alloys in which there is an excess of the good conductor, the peculiar properties of the four bronze alloys, Sn 2 Cu, Sn 3 Cu, Sn 4 Cu, and Sn 5 Cu, having already been mentioned, they would have nothing more to add to them if it were not to illustrate the extraordinary influence which tin exercises on the conductibility of copper, and also to show that when there is a great excess of a good conductor in an alloy it overcomes the resistance of the bad conductor, and, in consequence, the conductibility of such alloys increases with the proportion of the good conductor.

TIN AND COPPER.

Formula of the alloys and percentage.				Silver = 1000. Found.	Calc.
Sn = 27·10 +	5 Cu =	72·90	..	207	... 705
Sn 15·68	10 Cu	84·32	..	307	... 749
Sn 11·03	15 Cu	88·97	..	402	... 768
Sn 8·51	20 Cu	91·40	..	465	... 778
Sn 6·83	25 Cu	93·17	..	475	... 784

BISMUTH AND ANTIMONY.

Formula of the alloys and percentage.				Silver = 1000. Found.	Calc.
Bi = 62·26 +	Sb =	37·74	..	62	... 110
Bi 45·21	2 Sb	54·79	..	76	... 132
Bi 35·48	3 Sb	64·52	..	80	... 145
Bi 29·20	4 Sb	70·80	..	96	... 153
Bi 24·81	5 Sb	75·19	..	108	... 159

The influence of excess of equivalents of lead is not so striking. The alloys of zinc and copper do not offer the distinctive degrees of conductibility that the alloys of copper and tin or bismuth and antimony present; but this may be due to the conducting powers of copper and zinc being within a few degrees of each other.

ANTIMONY AND LEAD.

Formula of the alloys and percentage.				Silver = 1000. Found.	Calc.
Sb = 38·39 +	2 Pb =	61·61	..	190	... 251
Sb 23·68	4 Pb	76·32	..	204	... 265
Sb 17·20	6 Pb	82·80	..	221	... 271
Sb 13·48	8 Pb	86·52	..	219	... 274
Sb 11·08	10 Pb	88·92	..	230	... 276

COPPER AND ZINC.

Formula of the alloys and percentage.				Silver = 1000. Found.	Calc.
Cu = 49·32 +	Zn =	50·68	..	688	... 718
Cu 32·74	2 Zn	67·26	..	428	... 687
Cu 24·64	3 Zn	75·36	..	531	... 672
Cu 19·57	4 Zn	80·43	..	589	... 663
Cu 16·30	5 Zn	83·70	..	595	... 657

It is probable that Cu 2 Zn, and Cu 3 Zn are definite compounds, for not only have they a special conducting power of their own far below that of the metals composing them, but also they are perfectly crystallized. The most splendid of all the brass alloys is the alloy Cu Zn, which is of a beautiful gold color, and crystallized in prisms often 3 centims. long. These crystals are also interesting on account of their extraordinary elasticity. It is surprising that so cheap an alloy has not been employed in commerce, for no commercial brass contains more than 30 to 35 per cent. of zinc, whilst the above contains 50·68 of this metal. The only explanation appears to be that

if copper be alloyed with more than 50 per cent. of zinc, the alloys formed do not possess the color of brass, but become white as zinc; and, therefore, manufacturers have never tried to unite these metals in the exact proportions given above. It is remarkable that a variation of a few per cent. in the relative proportions of the two metals no longer yields the beautiful alloy noticed, but only a white and comparatively useless one.

Alloys with an excess of copper gave the following results:—Zn 2 Cu, found 621 (silver=1000), calculated 748; Zn 3 Cu, found 630, calculated 764; Zn 4 Cu, found 666, calculated 770; Zn 5 Cu, found 715, calculated 780. They also thought it useful to analyze the following commercial alloys and determine their respective conducting powers, and the results obtained were—Yellow brass (Cu=64+Zn=56), found 558 (silver=1000), calculated 712; pumps and pipes (Cu=80+Sn=5+Zn=7·5+Pb=7·5), found 426, calculated 707; mud plugs (Cu=80+Sn=10+Zn), found 394, calculated 754; large bearings (Cu=82·05+Sn=12·82+Zn=5·13), found 345, calculated 751. It is extraordinary to find what a low conducting power these alloys possess; for, with the exception of "yellow brass," they do not conduct heat better than wrought and cast iron; this is due to the impurity of the metals employed, and shows the advantage that there will be in substituting for them some of the much cheaper alloys above described. The second part of the paper on "Amalgams" will shortly be published.

Proximate Analysis of Coal Tar. By Mr. CRACE CALVERT.

From a communication addressed by this gentleman, and read before the Academy of Sciences of Paris, we extract the following account of the constitution of coal tar from different kinds of coals:

	Benzine.	Carbolic acid.	Paraffine.	Naphtaline.	Neutral hydrates of carbon.	Pitch.
Boghead,	12	3	41	0	30	14
Cannel,	9	14	0	15	40	22
Newcastle,	2	5	0	58	12	23
Staffordshire,	5	9	0	22	35	29

Of these substances, he remarks, that the carbolic acid alone possesses any practical amount of antiseptic power. But he finds this substance in so small a proportion as $\frac{1}{1000}$, very valuable as a preservative against offensive putrefactions. He states that the skin of an animal rubbed with carbolic acid on the inside, remained free from vermin for several years.

M. Chevreul reminded the audience that the carbolic acid has also been known under the name of Phenol, Phenic acid, Phenic alcohol, hydrate of phenyle.

For the Journal of the Franklin Institute.

Particulars of the Steamer Champion.

Hull built by Harlan & Hollingsworth & Co., Wilmington, Delaware. Machinery by Allaire Works, New York.—Owner, C. Vanderbilt.—Intended service, Pacific Ocean.

HULL.—

Length on deck, from fore part of stem to after part of stern post, above the spar deck, . . 242 feet.
" at load line, . . . 235 "
Breadth of beam, molded, . . 35 "
Frames—apart at centres, 18 and 20 inches—
" sketch of shape ⌶—depth 4 ins.—width 1¼ ins.
Plates—15 strakes from keel to gunwale.
" thickness, ¾, ⅞, ½, and 7-16th inches.
Cross floors—22 ins. high and 8 ins. apart—½ and 9-16ths inches thick, and capped with angle iron.
Keel ⋃—depth 7 ins., dimensions 3-16ths.
Rivets—diameter ¾ inches—apart 2½ inches—single and double riveted.
Depth of hold, . . . 18 " 2 inches.
" to spar deck, . . 25 " 10 "
Length of engine room, . . 66 "
Draft of water forward and aft, . 10 "
Tonnage, . . 1490.
Area of immersed section at load draft of 10 ft., 346 sq. ft.
Contents of bunkers in tons of coal, . 500.
Masts two—Rig—Foretopsail schooner.

ENGINES.—Vertical beam.

Diameter of cylinder, . . . 42 inches.
Length of stroke, . . . 10 feet.
Maximum pressure of steam in pounds, . 30.
Maximum revolutions at above pressure, . 20.
Cut-off—half stroke.
Weight of engines, . 340,000 lbs.

BOILERS.—Two—Return flued.

Length of boilers, . . 24 feet.
Breadth " . { Furnace, . 10 " 6 inches.
{ Shell, . 9 " 6 "
Height " exclusive of steam chimney, . 9 " 6 "
Weight " with water, 190,000 lbs.
Number of furnaces, . . (2 in each.) 4.
Breadth " . . . 4 " 8 "
Length of grate bars, . . . 7 " 1 "
Number of flues, . . { above 5. / below 10.
Internal diameter of flues, { below 2 of 21 ins. & 8 of 13 "
{ above, . 1 " 5½ "
Length of flues, . . { above, . . 17 " 4½ "
{ below, . 11 " 10 "
Heating surface, . 2491 sq. feet.
Diameter of smoke pipe, . . 5 " 7 "
Height " above grates, . . 56 "
Consumption of coal per hour, one ton.

PADDLE WHEELS —

Diameter over boards, . . 30 feet.
Length of blades, . . . 6 " 6 inches.
Depth " . . . 18 "
Number " . . . 26.

Remarks.—One independent steam, fire, and bilge pump—boil-

ers, chimney, and smoke pipe protected from communicating fire, by felt and iron. Three bulkheads; 12 fore and aft keelsons—2 of 42 inches high by $\frac{9}{16}$ths thick, and 10 of 20 inches high by $\frac{9}{16}$ and $\frac{1}{2}$ ins. thick. Stringers on main deck 14 by $\frac{1}{2}$ ins. Deck clamps L 26 by $\frac{5}{8}$ inches; 79 state rooms; 315 steerage berths. Date of trial, September, 1859. C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steamer R. R. Cuyler.

Hull built by Samuel Sneden. Machinery by Allaire Works, New York. Intended service, New York to Savannah.

HULL.—

Length on deck,	235 feet.
Breadth of beam,	32 "
Floor timbers—at throat *molded* 14 ins., *sided* 10 and 12 ins.	
Frames—*apart at centres* 24 inches.	
" strapped with diagonal and double laid iron straps 4 by $\frac{5}{8}$ inches.	
Depth of hold,	16 " 6 inches.
" to spar deck,	23 " 3 "
Length of engine, boiler, and coal space,	66 "
Draft of water at load line,	18 "
" below pressure and revolutions,	18 "
Area of immersed section at this draft, 548 sq. ft.	
Tonnage, custom house, 1600.	
Contents of bunkers in tons of coal, 150.	
Masts and rig—Foretopsail schooner.	

ENGINES—Vertical direct.

Diameter of cylinder,	70 inches.
Length of stroke,	4 feet.
Maximum pressure of steam in pounds, 25.	
Cut-off at one half stroke.	
Maximum revolutions per minute, 45.	

BOILERS—Two—Horizontal tubular.

Length of boilers,	17 feet 4 inches.
Breadth "	13 " 6 "
Height " exclusive of steam chimney,	13 " 9 "
Number of furnaces, 6.	
Breadth of furnaces,	3 " 11 "
Length of grate bars,	7 " 6 "
Number of tubes, 288.	
Internal diameter of tubes,	4 "
Length of tubes,	14 "
Heating surface, (fire and flues,) 6285 sq. ft.	
Diameter of smoke pipes,	4 " 4 "
Height "	21 "
Description of coal, Anthracite.	
Draft, Natural.	
Consumption of coal per hour, 0·71 tons.	

PROPELLER.—

Diameter of screw,	16 feet.
Length of blades,	4 " 9½ inches.
Pitch of screw,	22 " 6
Number of blades, 4.	

C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steam Ferry Boats Marion and Gen. Warren.

Hulls built by Rosevelt & Joyce. Machinery by Novelty Iron Works, New York. Intended service, New York to Brooklyn.

HULL.—

Length on deck, from fore part of stem to after part of stern post, above the spar deck,	142 feet	6 inches.
Breadth of beam at midship section,	33 "	
Floor timbers, at throat—*molded*, 13 ins.—*sided*, 5½ ins.		
Frames—*apart at centres*, 24 ins.		
Depth of hold to spar deck,	12 "	4 "
Length of engine and boiler space,	59 "	
Draft of water at load line,	6 "	
Draft of water at below pressure and revolutions,	6 "	
Area of immersed section at this draft, 170 sq. ft.		
Tonnage, custom house, 521.		

ENGINE.—Vertical beam.

Diameter of cylinder,		38 inches.
Length of stroke,	9 feet.	
Maximum pressure of steam in pounds, 25.		
Cut-off, at	4 "	6 "
Maximum revolutions per minute, 28.		
Weight of engines and wheels *in pounds*, 63,700.		

BOILER.—One—Cylinder, with drop return flues.

Length of boiler,	25 feet.	
Weight " without water, *in pounds*, 31,159.		
Number of furnaces, 2.		
Breadth "	3 "	10 inches.
Length of grate bars,	6 "	10 "
Number of flues, 16.		
Internal diameter of flues, 14 of 14 ins., 2 of 24 ins.		
Length of flues, { upper and lower,	13 "	5 "
Length of flues, { centre,	11 "	3½ "
Heating surface (fire and flue), 1198 sq. ft.		
Diameter of smoke pipe,	3 "	4 "
Height " from top of boiler,	40 "	
Description of coal, Bituminous.		
Draft, Natural.		

PADDLE WHEELS.—

Diameter,	18 feet	6 inches.
Length of blades,	8 "	
Depth "		24 "
Number " 18.		C. H. H.

Straw Matting.

The Abbè Moigno notices in the *Cosmos* the introduction of a new article, which is a tissue of straw, made of indefinite length, and of any breadth not greater than one metre, ($1_{1}^{1}{}_{2}$ yards.) It is made by uniting plaits of the straw by thread of preserved hemp or galvanized on tin wires. The fabric is made in a loom, and at the rate of 100 sq. yards per day by a single skilled workman. These mattings are extensively used to protect the vineyards and gardens, and experience seems to show that they form a very valuable improvement.

Cosmos, 1st July, 1858, p. 8.

For the Journal of the Franklin Institute.

Particulars of the Steam Ferry Boats Ethan Allen and Commodore Perry.

Hulls built by Thomas Stack, Williamsburgh. Machinery by Novelty Iron Works, New York. Intended service, New York to Brooklyn.

HULL.—

Length on deck, from fore part of stem to after part of stern post, above the spar deck,	144 feet	6 inches.
Breadth of beam,	33 "	
Floor timbers, at throat—*molded*, 13 ins.—*sided*, 5½ ins.		
Frames—*apart at centres*, 24 inches.		
Depth of hold,	12 "	
Length of engine and boiler space,	59 "	6 "
Draft of water at load line,	6 "	
" below pressure and revolutions,	6 "	
Area of immersed section at this draft, 170 sq. ft.		
Tonnage, 527.		

ENGINE.—Vertical beam.

Diameter of cylinder,		38 inches.
Length of stroke,	9 feet.	
Cut-off at,	4 "	6 "
Maximum pressure of steam in pounds, 25.		
" revolutions per minute, 28.		
Weight of engines *in pounds*, 63,700.		

BOILER.—One—Drop flued.

Length of boilers,	25 feet.	
Breadth "	9 "	
Weight " without water, 31,159 lbs.		
Number of furnaces 2.		
Width "	3 "	10 inches.
Length of grate bars,	6 "	10 "
Number of flues, 16.		
Internal diameter of flues, 14 of 14 ins., 2 of 24 ins.		
Length of flues, upper,	13 "	5 "
Length of flues, lower,	11 "	3½ "
Heating surface, 1198 sq. ft.		
Diameter of smoke pipe,	3 "	
Height "	40 "	
Description of coal, Anthracite.		
Draft, Natural.		

PADDLE WHEELS.—

Diameter,	18 feet	6 inches.
Length of blades,	8 "	
Depth "	2 "	
Number " 18.		

C. H. H.

Persistent Activity of Light.

In former numbers of our *Journal* we have given an account of the extraordinary experiments of M. Niepce de St. Victor, by which it was shown that when a sheet of paper impregnated with certain substances, (*i. e.* tartaric acid,) is exposed to the solar light and then enclosed in a perfectly tight box, a photographic action takes place, by which pictures may be printed as though in the light.

This subject has been farther investigated by M. l'Abbè Laborde,

who is led by his experiments to conclude that the active agent "is an emanation, not a radiation."

The following are two of his experiments:

I. The sensitive paper was partly covered by a glass plate in contact with it; another plate of glass or ivory was placed across the first, so as to oppose the direct radiation from the part which it covered, but not to the circulation of any vapors emanated; when the box was opened, the paper was found evenly blackened throughout, except under the glass in contact with the paper.

II. The box containing the insolated sheet was left for four hours in a warm place. M. Laborde then opened it carefully, and holding the opening downwards, gently withdrew the sheet; then quickly fixing the sensitive paper upon the cork, he re-closed the box and placed it in a cool place. When it was again opened, after twelve hours, the sensitive paper was found blackened, notwithstanding the absence of the insulated sheet.—*Cosmos.*

For the Journal of the Franklin Institute.

Further Performance of the U. S. Steam Sloop "Wyoming."

In the last number of this *Journal* (p. 267), the results of the engineers' trial trip of this ship were given. Since which, the ship having departed on a cruise to the Pacific, the capacity of her machinery was tested in the Delaware Bay, and the result reported from the Breakwater. On this occasion, the coal used was "Broad Top," mined in Pennsylvania, a "semi-bituminous" coal, free from sulphur, emitting no smoke except when freshly fired, and of free burning properties. The draft of the ship was greater than on the previous trial, viz:—

Forward, ... 13 feet 3 inches.
Aft, ... 13 " 4 "

During the passage down the Delaware, the following is the

STEAM LOG.

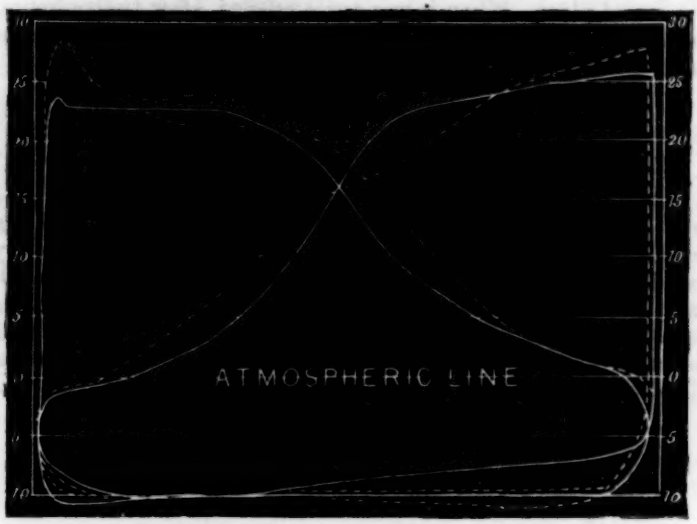
Hour.	Steam pounds.	Vacuum inches.	Throttle open.	Cut-off inches.	Coal pounds.	Revolutions per minute.
9 to 10	27	25·0	·28	Variable from 12·5 to 16·5. Averaging 14 inches.	3136	67·1
11	26	23·0	·40		3584	73·0
12	26	23·0	·40		1792	75·1
1	25	23·5	·40		1000	73·0
2	25·5	23·0	·55		1240	76·1
3	24	23·0	·40		1755	69·0
4	25	23·2	·40		2223	75·3
5	24	23·0	·40		2680	69·2
	25·25	23·34	·39	14·0	1897	72·3

Average H. P. developed in whole time, . 791·54 (calculated.)
" coal per H. P. per hour, in pounds, . 2·40 including spreading fires.
Highest H. P. developed by indicator diagram, 1088·7 at 80½ revolutions.
" number of revolutions per minute, 85.
All the furnaces (14) were in use during this time.

The following diagrams show the performance of the engines at the time the above power was indicated.

Forward Engine. (Full lines.)	
Date and hour,	Oct. 5, 1·5 P. M.
Revolutions per minute,	80·5
Pressure of steam,	27·0
Throttle valve,	wide.
Vacuum,	23·5
Cut-off,	15 ins.
Mean pressure,	22·09
Indicated H. P.,	528·88

After Engine. (Dotted lines.)	
Date and hour,	Oct. 5, 1·5 P. M.
Revolutions per minute,	80·5
Pressure of steam,	27·0
Throttle valve,	wide.
Vacuum,	23·5
Cut-off,	16 ins.
Mean pressure,	23·22
Indicated H. P.,	559·89



The speed of the ship at the above deep draft (having 266 tons of coal on board at starting), was 10·58 geographical miles per hour, and when the above cards were taken, the log showed a speed of 11·25 knots per hour. The slip of the screw averaged 20·6 per cent.

On the outward trip to Charleston reported in the last number of the *Journal*, the slip was 16 per cent., the ship drawing on an average 13 feet aft, 12 feet forward.

On the homeward trip the slip was 19·1 per cent., the ship drawing on an average 12 feet 8 inches aft, 11 feet 10 inches forward.

It would thus appear that at sea the slip would average in smooth weather and half coal in, about 17 to 18 per cent.

Evaporation of the Boilers.

By reference to the indicator diagram taken during the homeward passage from Charleston (*vide* p. 271), and to that of the after engine at the same time (not published), it appears that, by averaging all

four ends, the actual point of cutting off was 10·2 inches, and the initial pressure of steam entering the cylinders, 15·3 pounds above the atmosphere, of which the volume is 880.

The total clearance and space in ports for each end equals 1·9 inches of stroke.

The volume of steam used, by the diagrams, was therefore 10·2+1·9=12·1 inches of stroke, or for four ends, $12{\cdot}1 \times 4 = 48{\cdot}4$ inches; and, as the area of each cylinder is 1964 sq. inches, the volume was $1964 \times 48{\cdot}4 \times 72$ revolutions = 6844104 cubic inches = 3960 cubic feet of steam; $\frac{3960}{880} = 4{\cdot}50$ cubic feet $\times 62{\cdot}5 = 281{\cdot}5$ pounds of water per minute.

The coal consumed averaged 2·73 pounds per hour per H. P., or $\frac{2{\cdot}73 \times 640{\cdot}8}{60} = 29{\cdot}15$ pounds per minute. Hence $\frac{281{\cdot}5}{29{\cdot}15} = 9{\cdot}65$ pounds of water evaporated by one pound of fuel.

By the diagrams given above, the mean point of cutting off in all four ends was 13·7 inches; and the mean entering pressure, 22·8 pounds above the atmosphere, of which the volume is 717. Hence $\frac{13{\cdot}7+1{\cdot}9=15{\cdot}6 \times 4 \times 1964 \times 80{\cdot}5}{1728} = 5709$ cubic feet of steam per minute; $\frac{5709}{771} = 7{\cdot}404 \times 62{\cdot}5 = 462{\cdot}75$ pounds of water per minute.

As this trial was too short to indicate the correct hourly consumption of fuel, the rate per H. P. per hour may be assumed as the same as previously found, viz: 2·73 pounds; and the consumption would then be $\frac{1088{\cdot}7 \text{ H. P.} \times 2{\cdot}73}{60} = 49{\cdot}5$ pounds of coal per minute. Therefore $\frac{462{\cdot}75}{49{\cdot}5} = 9{\cdot}32$ pounds of water per pound of fuel, as the rate of evaporation.

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*Gilding Textile Fabrics.**

Gold stuffs are generally manufactured by weaving gold thread, which renders the tissue stiff and heavy. M. Burot has just discovered a method of gilding stuffs by means of electrical agency. The piece to be gilt, whether made of silk or any other material, is dipped into a solution of nitrate of silver and ammonia; after remaining in this solution a couple of hours, the stuff is taken out, and when dry exposed to a current of pure hydrogen gas, which reduces the salt, and leaves the silver in a metallic state on the stuff. A silvered surface is thus obtained, which is easily gilt over by the usual galvanoplastic methods. Beautiful specimens of gilt and silvered lace were exhibited in London some five years since. They were of French origin, but the process was not made known.

* From the Lond. Mechanics' Magazine, January, 1850.

For the Journal of the Franklin Institute.

Remarks on the Aurora of August 28th, 1859.

By Benjamin V. Marsh.

In this, as in other great auroral displays, there were evidently two systems of bodies or appearances situated in planes nearly at right angles to each other.

First. *Horizontal* bands of dense whitish cloud, stretching across the heavens in nearly an east and west direction, in the form of arches.

These were few in number; but the spaces between them were mostly occupied by numerous fragments and narrow irregular streams of the same material, running parallel to the bands—the whole forming a kind of luminous curtain, covering more than three-fourths of the visible heavens, leaving only segments of clear sky near the northern and southern horizons.

Second. *Vertical* "streamers" of great brilliancy and splendor in the form of columns having their bases in the horizontal curtain, and extending up from it to immense heights, and visible *through* the luminous curtain.

A scene changing so frequently and rapidly, was, of course, very unfavorable for accurate measurements, but fortunately the southern margin of the luminous curtain, as seen from Philadelphia and vicinity, remained well defined and nearly stationary for more than three-quarters of an hour, commencing at half past 8 o'clock or earlier, thus affording a good opportunity for determining its position.

As to its elevation above the southern horizon during this interval, I have the following information:—

1. At Newburyport, Mass. Latitude 42° 48½′.

An article signed "*P*," in the *Newburyport Herald* of August 30th, in the course of a careful and detailed account of its progress, says that at 9 o'clock (8¾ Philadelphia time), "Lambda Scorpii marked its southern border."

The altitude of Lambda Scorpii at 9 o'clock at Newburyport was 5¾ degrees; and a great circle passing through this star at that time, and cutting the horizon at the east and west points, crossed the meridian at an altitude of 6 degrees, which must correspond very nearly to the altitude of the highest point of the margin of the curtain above the southern horizon.

2. At New Haven, Conn. Latitude 41° 18′.

Prof. C. S. Lyman and Mr. E. C. Herrick ascertained its minimum elevation between half past 8 and 9 o'clock to be from 10½ to 12 degrees.

3. At Burlington, N. J. Latitude 40° 5′.

Samuel J. Gummere *estimated* its altitude between half past 8 and 9, to be from 18 to 20 degrees, but made *no measurements*.

4. At Philadelphia. Latitude 39° 57′.

Soon after half past 8, Charles J. Allen carefully noted its position between two fixed objects, and afterwards ascertained by actual mea-

surement that this gave an elevation of about 22½ degrees above the southern horizon.

5. At Sandy Spring, Md. Latitude 39° 9′.

Prof. Benjamin Hallowell of Alexandria, says, "the elevation of the southern margin of the luminous curtain above the southern horizon, I thought, and mentioned to those with me, was about the meridian altitude of the equator, say 51 degrees."

Assuming the direction of the southern margin of the curtain to have been due east and west, and calculating its height and position from the above data, I find the following results.—

						HEIGHT IN MILES.	LAT. SOUTH. MARGIN.
Newburyport	6,	and	New Haven	10½,	give,	49·9	38° 0′
"	6,	"	"	11¼,	"	41·3	38 39½
"	6,	"	"	12,	"	35·8	39 6
"	6,	"	Burlington	18,	"	49·3	38 3
"	6,	"	"	19,	"	46·5	38 15
"	6,	"	"	20,	"	44·3	38 25½
"	6,	"	Philadelphia	22½,	"	43·2	38 31
New Haven	10¼,	"	Burlington	18,	"	48·7	38 4¼
"	10¼,	"	"	19,	"	43·9	38 21¼
"	10¼,	"	"	20,	"	40·4	38 34
"	11¼,	"	"	18,	"	59·6	37 39
"	11¼,	"	"	19,	"	52·5	38 2
"	11¼,	"	"	20,	"	47·5	38 18¾
"	12,	"	"	18,	"	74·2	37 6½
"	12,	"	"	19,	"	63·5	37 38
"	12,	"	"	20,	"	56·3	38 0
"	10½,	"	Philadelphia	22½,	"	38·9	38 39¼
"	11¼,	"	"	22½,	"	44·6	38 28
"	12,	"	"	22½,	"	51·5	38 15
Sandy Spring	51,	"	Newburyport	6,	"	41·1	38 40¾
"	51,	"	New Haven	11¼,	"	40·9	38 41
"	51,	"	Burlington	19,	"	32·8	38 46½
"	51,	"	Philadelphia	22½,	"	36·5	38 44
			Average,			47·1	38° 18¼′

The above table is intended to exhibit the whole range of results from the preceding data, but the following are, no doubt, the most reliable items.

						HEIGHT IN MILES.	LAT. SOUTH. MARGIN.
Newburyport	6,	and	New Haven	11¼,	give,	41·3	38° 39½′
"	6,	"	Philadelphia	22½,	"	43·2	38 31
New Haven	11¼,	"	"	22½,	"	44·6	38 28
			Average,			43·0	38° 33′

The position of the corona has usually been observed to correspond with that of the pole of the dipping needle (which, at Philadelphia, is about 18 degrees south of the zenith), indicating that the tops of the streamers are inclined southward, at an angle of 18 degrees from a vertical position.

Assuming this to have been true in this instance, and that the streamers had their bases in the curtain at the height of 43 miles, observations made in Cuba, and published in the "*Diario de la Marina*" of August 30th, give us the means of determining their position and length.

At Havana no mention is made of the arch or curtain (which was, doubtless, below the Cuban horizon), but the streamers are described as ascending to the height of the pole star.

At Burlington several streamers were observed issuing from the southern side of the corona, but none approached within 45 degrees of the southern horizon. Therefore their bases, if only about 43 miles high, could not have been south of the 39th parallel of latitude. The entire absence of auroral light below the arch, proves these to have been the *only* streamers south of Burlington in this longitude, and, consequently, that they were probably the *identical* streamers seen in the north by the Cubans.

Supposing, then, that they sprang from the curtain in latitude 39°, and that, as seen from Havana, they had an elevation equal to that of the pole star, I find their length 578 miles, and that their tops were situated nearly in latitude 36° 47′, at a vertical height of 596½ miles.

This would give Norfolk as the most southern point at which the streamers would appear to reach the zenith—the display at all places further south being confined to the northern heavens.

Among the most constant features of the display at Burlington, were two large irregular masses or patches of light, remaining pretty nearly stationary during most of the evening, one in the east, and the other about 15 degrees north of west, each at an elevation of from 10 to 20 degrees above the horizon, varying greatly in color and brightness, but evidently sympathizing with each other in all their changes.

The east and west bands seemed to terminate in these masses which were evidently the places of convergence of the parallel streams composing the curtain, but their brilliancy and the variety of their colors were far too great to be due to these whitish streams alone.

Prof. B. Hallowell, of Alexandria, says, "There appeared to be two foci of auroral light maintaining pretty nearly a constant position the greater part of the evening, but varying materially in color at different times, and also in the number and brightness of the streamers issuing from them. We thought one of them was a little north of west, and the other a little south of east. I should judge the centre of each to have been about 10 degrees above the horizon."

The *Steubenville Ohio Journal*, of August 30th, speaks of "the two centres in the north-east and the north-west, with a fitful gleam between them."

In England the lights in the north-east and south-west, particularly the latter, attracted general attention, and were, in some instances, supposed to arise from a great conflagration; and various accounts in this country refer to the luminous clouds in the east and west; from all which it is evident that the phenomenon was not local but general.

At Burlington, during a considerable time (probably thirty minutes

and perhaps much longer), preceding half past 9, a segment 10 or 15 degrees in height over the northern horizon, was perfectly free from the aurora, showing the limit of the curtain in that direction. This margin, however, was neither so regular nor so well defined as the southern.

The correspondent "*P*," of the *Newburyport Herald*, already quoted, says, "At a quarter before 10" (9½ Philadelphia time), "the northern border of a luminous arch passing from east to west, was marked by Nu in the right foot of the Swan, while the whole southern and south-western heavens were glowing with streamers rushing to the elevated pole of the magnetic dip, *the whole northern heavens being entirely destitute of auroral light.*"

Since Nu Cygni was then nearly in the zenith, it appears from the above that, previous to half past 9, Philadelphia time, the northern border of the curtain was vertical over Newburyport. Consequently the total width of the curtain at this time, must have been only four and a half degrees of latitude, or about 315 miles.

In England the prevalence of clouds interfered with complete observations, but from the *London Times* we learn that Mr. Lowe noted a splendid display at half past 2 (corresponding with half past 9, Philadelphia time, its period of maximum brilliancy in this country, and thus proving the phenomena to be identical), and that an observer at Brighton saw a band stretching from south-west to north-east by east.

At Stockton, California, the *San Joaquin Republican* of August 31st, says, "It appeared about 9 o'clock as a faint white light commencing about north and extending to about east by north. In about 10 minutes later great streams of red and blue shot up all along the north-eastern horizon, but they appeared to shoot up highest about midway of the light."

A consideration of all the preceding statements seems to justify the conclusion that the luminous horizontal curtain was in the form of a ring, the centre of which was probably situated in or near the northern part of Davis' Straits—its direction having been shown to be nearly north-west from England, a few degrees east of north from Philadelphia, and north-east from California—that this ring was about 43 miles from the earth, and that its width, previous to half past 9 o'clock, was about 315 miles; and furthermore, that from various points on its surface, arose splendidly illuminated vertical columns several miles in diameter, and near 600 miles high, and that these columns were at all times at very considerable distances from each other —one streamer for every five hundred square miles being more than sufficient to satisfy all observations.

We have, therefore, overlying the annular curtain, an annular stratum or zone 550 miles in thickness, composed entirely of vertical streamers, the whole forming a thick ring having the curtain for its lower boundary; and I think it is to these vertical streamers that we must look for the cause of the fixed masses of light in the east and west.

It will be recollected that these were conspicuous during nearly the whole evening, although the display of streamers was, during a great part of the time, quite limited. Now, an observer at Philadelphia in looking north, looks across the ring and through a comparatively moderate thickness of streamers, even when viewing a point as much as 45 degrees above the horizon; but, in looking east or west, he looks through the same lengthwise, and consequently through a very great thickness of the streamer-bearing zone.

The result is, that in the north he sees an occasional streamer comparatively near to him, and therefore distinctly defined, while towards the eastern horizon the light of a great many very distant streamers is so completely blended as to give the effect of a diffused and steady brightness.

Had the curtain with its overlying stratum of streamers extended indefinitely east and west, the brightness would probably have been about the same at the horizon (except so far as affected by the want of perfect transparency in the atmosphere), as at 10 or 20 degrees above it, the greater distance of the streamers from the eye being counterbalanced by their greater number. But, in this instance, the curtain being in the form of a ring of comparatively small diameter, its curvature carried it greatly to the northward before the whole thickness reached the horizon—the southern margin of the upper surface of the ring only reaching the horizon when as far north as the centre of the fixed light. Consequently, south of this point the depth of streamers looked through at the horizon, must diminsh rapidly (without a corresponding diminution at greater elevations), and the light speedily vanish.

This corresponds with the phenomena as observed, and we may therefore conclude that these "foci" in the east and west, although coinciding in position with the places of convergence of the horizontal streamers, derive their color and brilliancy chiefly from vertical streamers, and that if the streamer-bearing curtain had extended indefinitely northward, we should have observed the same phenomena in that direction also.

It should be remarked, that if the centre of the ring had the place I have assigned it, some changes must be made in my calculations for determining the height, which will tend slightly to increase it.

The sudden projection of the streamers to such vast heights from the curtain, seems to bear a striking analogy to the formation of the tails of comets, and suggests the inquiry whether they are not, in like manner, the effect of a repulsive force.

Philadelphia, October 18th, 1859.

On the Freezing Point of Water in Capillary Tubes.

Many years ago M. Donnè showed that water enclosed in narrow tubes of a substance capable of being wetted by it, might be raised to a temperature considerably above 212° without boiling—and these experiments have been made the basis of several attempts to account for the

explosions of steam boilers. Mr. H. C. Sorby, in a note communicated to the London, Edinburgh, and Dublin Philosophical Magazine, completes these researches by showing that in capillary tubes, the temperature of water may be lowered far below 32° without freezing even when the tubes are shaken. In tubes of from $\frac{1}{200}$ or $\frac{1}{300}$ inches in diameter, the water may be reduced to 5° Fah., without freezing, provided it be not in contact with ice. These experiments go to show that these phenomena are caused by the adhesion of the water to the walls of the tube interfering with its change of state; and thus lead to the belief that they have no application to water in large vessels, such as steam boilers.

New Disinfecting Powder.

MM. Corne and Demeaux propose as a powerful disinfectant, a mixture of powdered plaster of Paris, with two or three per cent. of coal tar. M. Velpeau, the celebrated surgeon, and director of the Hospital *La Charité*, speaks of it in the most energetic terms as perfectly successful in disinfecting the most offensive ulcers, (to which it is applied as a plaster,) and assisted their healing; and in rendering entirely inodorous the masses of semi-putrescent matters in the dissecting room. So highly did he think of its value, that he urged the Academy of Sciences to waive their usual rule of awaiting the report of their Committee, and to recommend the Minister of War at once to use it for the wounded in the late Italian war.—*Cosmos*, July 22, 1859, p. 106.

New Material for Buttons.

Excellent buttons and even handsome cameos may be made with talc or steatite, provided after they are made they be heated for several hours at a nearly white heat. By this strong calcination, the steatite gets so hard that it strikes fire with flint, and resists the best tempered file. They may be polished by emery, tripoli, and jeweler's putty; and colored by mineral or organic matters; chloride of gold colors them purple; nitrate of silver, black; exposure to the reducing flame increases very much the brilliancy of the color.

Cosmos, July 22, 1859, p. 92.

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*Coal Supply of Great Britain.**

The coal fields of Great Britain yield nearly 70,000,000 tons per year. A better idea of the immense commerce of England could not be formed than by stating the fact that at Manchester and its environs a motive steam power equal to 1,200,000 horses is constantly maintained, to support which there are consumed 30,000 tons of coal per day, or 9,500,000 a year. In the manufacture of salt alone, about

*From the Lond. Practical Mechanics' Magazine, April, 1859.

3000 tons are consumed per day, or 950,000 a year. The Transatlantic steamers from Liverpool and other ports consume 700,000 tons per year, and the manufacture of gas absorbs at least 10,000,000 tons per year. The export of coal from England reached, in 1858, 6,078,000 tons. It is estimated that England alone could furnish enough coal for the consumption of the whole of Europe for the space of 4000 years.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, October 20, 1859.

John Agnew, Vice-President, in the chair.

John F. Frazer, Treasurer.

Daniel R. Ashton, Recording Secretary, P. T.

The minutes of the last meeting were read and approved.

Letters were read from the Royal Geographical Society, London; the K. K. Geographischen Gesellschaft, Vienna, Austria; and Capt. C. Wilkes, U. S. N., Washington, D. C.

Donations to the Library were received from the Royal Geographical Society, and the Chemical Society, London; L. A. Huguet-Latour, Esq., Montreal, Canada; Capt. C. Wilkes, U. S. N., Washington, D. C; and from Prof. John C. Cresson, and the American Philosophical Society, Philadelphia, Pa.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of September, was read.

The Board of Managers and Standing Committees reported their minutes.

Candidates for membership in the Institute (17) were proposed, and the candidates proposed at the last meeting (6) were duly elected.

Mr. Howson exhibited a specimen of C. Sharp's breech-loading repeating pocket pistol. It consists of a barrel block having four bores, the block being arranged to slide along the stock to and from the breech, which is stationary. When the barrel block is slided out, a metallic cartridge is inserted into each bore, and the barrel block pushed back and locked against the breech. A very ingeniously contrived rotating nipple on the hammer, strikes one corner of each cartridge in succession. Mr. Howson remarked that more accurate aim could be taken with this pistol than with an ordinary revolver, and that it could be as rapidly loaded and discharged. Patents have been granted in this country, England, France, and Belgium for Mr. Sharp's invention.

Mr. Howson also exhibited a specimen of Mr. Warburton's patent perforated hat. The novelty in this invention consists in using heated points for making the perforations. In piercing the body of the hat with these points, the shellac stiffening melts and a clear hole is made through the body without breaking or crushing the material of which the body is made.

Mr. H. also exhibited J. Higginbotham's improved stop valve, in which the ordinary screw spindle is dispensed with and the valve raised and lowered by means of a cam. The object of this invention is to prevent the leaking of the stuffing box caused by the screw spindles of ordinary stop valves, and to afford facilities for grinding the valve to its seat.

In reply to a question by a member, "If any plan to propel the cars on City Passenger Railroads had been proposed in lieu of horses," it was stated by one of the Committee on Meetings, that the Caloric or Hot Air Engine was about to be applied to that purpose in New York, the first machine being nearly ready for trial; and, from the known fertility of resources possessed by the engineer making it, but little doubt of its success might be entertained.

Another means of propulsion seems to have been hit upon by several persons, as soon as the necessity for some cheaper motor than horse flesh became apparent. The directors of two or three roads, on application, were advised to use compressed air, operating engines of small cylinder capacity, running quickly, and supplied with air of a high density; the motion being transmitted through geared wheels to the driving axles. With either of these plans no change would be required in the existing cars, as the engines could be suspended beneath the floors, or on one of the platforms, whilst the air reservoirs could be placed on either side of the car, and form the seats. If reservoirs of a capacity sufficient to maintain a working pressure during the entire run could not be had, they might be refilled at some intermediate point, say at the intersection of a cross road, where the compressing engines and supply reservoirs might be stationed, thus serving two roads: the time occupied in filling the reservoir being merely that consumed in making the attachment, say one minute. The heavy grades on some of the roads can be overcome by a change of gear wheels operated by the engine man; the engines running at usual speed, whilst that of the car is reduced one-half or one-third. The objections urged against the use of steam, as, danger of explosion, heat and smoke, are nearly removed, whilst the exhaust motor being invisible would give no fright to horses. Vehicles could be warned off the track by an air-whistle, and the approach to a crossing or a connecting road made known. It is said that an air engine is being built for a Philadelphia road by a competent engineer who has just completed a successful locomotive engine driven by compressed air, for a road in the mining region. It has two cylinders of moderate capacity supplied with air of 200 lbs. initial pressure, contained in a reservoir of about 75 cubic feet. With the above pressure it ran about 2000 feet, pushing six loaded drift-cars upon which were clustered over 50 men. No novelty is claimed in the use of compressed air as a motor, numerous experiments and successful workings being recorded in books; but it seems to be specially adapted to this purpose, and will, no doubt, much reduce the running expenses of cars, each of which requires six horses per day to make its usual trips.